

CALIFORNIA STRAWBERRY COMMISSION

PEST MANAGEMENT EVALUATION for

Strawberries in California

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**An Evaluation of Soil-Borne Pest Management for Strawberries in California
in the Absence of Methyl Bromide**

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ABSTRACT:

CALIFORNIA STRAWBERRY COMMISSION

PEST MANAGEMENT EVALUATION

For Strawberries in California

California produces 80% of fresh market strawberries. These strawberries are grown on roughly 23,000 acres per year and have an estimated annual value of 580 million dollars. For most of this century, the strawberry industry has relied on both chemical treatments and cultural practices to treat soil borne diseases, insects and weeds so that these pests would not significantly impact the fruit yield and/or quality. One of the tools that the industry has heavily relied upon is methyl bromide, a broad-spectrum soil fumigant, applied in combination with chloropicrin.

Methyl bromide has properties that have been identified as being problematic to both the environment and public health and it will therefore be phased out by the year 2001. There are no broad-spectrum soil fumigant options currently available to the strawberry industry that are ready for widespread use and will fully replace the control provided by methyl bromide. The continued economic success of the strawberry industry in California will be based, in part, on the industry's ability to develop a pest management program that balances cultural and biological control practices with chemical treatment.

This document discusses the current pest management program used by the strawberry industry, including cultural practices, biological control and chemical treatments. It also discusses potential reduced risk pest management practices that may help the industry address the impending challenges from the loss of the industry's key pest control tool, methyl bromide.

CALIFORNIA STRAWBERRY COMMISSION

PEST MANAGEMENT EVALUATION

For

An Evaluation of Soil-Borne Pest Management for Strawberries in California in the Absence of Methyl Bromide

I. INTRODUCTION:

California is first in strawberry production in the United States, producing 80% of fresh market strawberries. These strawberries are grown on roughly 24,000 acres per year and have an estimated annual value of approximately 580 million dollars. The continued economic success of the strawberry industry in California will be based, in part, on the industry's ability to develop a pest management program that balances cultural and biological control practices with chemical treatment.

For most of this century, the strawberry industry has relied on both chemical treatments and cultural practices to treat soil borne diseases, insects and weeds so that these pests would not significantly impact the fruit yield and/or quality. In recent decades, one of the tools that the industry has heavily relied upon is methyl bromide, a broad-spectrum soil fumigant, applied in combination with chloropicrin. The mixture of these two fumigants has proven highly effective due to the unique ability of methyl bromide to penetrate the soil and "find" adverse soil-borne pests as well as the higher fungal toxicity of chloropicrin. Pre-plant applications control many soil borne diseases, including most agronomically important diseases, prevents weed germination, and kills arthropods that may be present in the soil. In addition, methyl bromide is used as a pre-plant soil fumigant in both the nursery and the field as a means of protecting the strawberry stock from infection and infestation.

Though methyl bromide is an effective pest management tool that currently is crucial to the agronomic practices of California's strawberry industry, the compound has properties that have been identified as being problematic to both the environment and public health. Methyl bromide has been identified as having the potential to deplete the Earth's ozone layer, and has become highly regulated and is being phased-out. Domestic production of methyl bromide has been frozen at 1991 levels and the importation and production of methyl bromide will cease by the year 2001. There are no broad-

spectrum soil fumigant options currently available to the strawberry industry that are ready for widespread use and will fully replace the control provided by methyl bromide.

The use of methyl bromide as a key pest management tool has resulted in relative economic stability for the California strawberry industry for many years. With the impending loss of methyl bromide as a pest management tool, the strawberry industry faces the challenge of developing a sound, multi-faceted, reduced-risk approach to integrated pest management that will provide viable biological controls, cultural practices and chemical tools for disease, insect and weed control.

II. SUMMARY OF INFORMATION REGARDING PEST COMPLEXES:

Hectarage of production strawberries in California has increased by over 78% from 5,666 hectares in 1985 to 10,117 hectares in 1996. Strawberry production in California occurs primarily along the central and southern coast, with a small amount in inland areas. These areas can be divided into five different growing regions: Central Coast, Santa Maria Valley, Oxnard Plain, South Coast and the San Joaquin Valley. Although each of these regions has unique growing conditions (e.g.: weather, soil conditions), growers face many of the same pest problems.

The table entitled Pest Management Evaluation Guide (Appendix 1) summarizes the crucial pests impacting California's strawberry industry and the cultural, biological and chemical methods that are available for managing these pests. The relative efficacy and economic viability of these methods are summarized in the table and detailed in the following sections of this document. Appendix 2 encloses a copy of the 1996 Pest Management Survey Database for strawberries in California. This Database was developed jointly by the UC Statewide IPM Project and the Department of Pesticide Regulation.

DISEASES. Diseases are potentially serious economic problems in all strawberry growing areas within the state of California. The impact of the disease depends on regional weather and soil conditions, quality of planting materials, and cultural practices. Coastal areas and nurseries tend to have cool, damp conditions that are favorable for disease development. Plant diseases involve complex interactions of causal agents, host plant and environmental factors. The use of good cultural practices, certified transplants, and soil fumigation has allowed the strawberry grower to minimize the impact of plant diseases.

Diseases are generally identified by the part of the plant that is infected. The most agronomically important diseases are listed below. Complete descriptions of each disease are enclosed in Appendix 3. These descriptions are summaries of these pests and their management that have been developed by the UC Statewide Integrated Pest Management Project.

Fruit Disease:	Anthracnose
	Botrytis Fruit Rot (Gray Mold)
	Rhizopus Rot (Leak)
	Mucor Fruit Rot
	Leather Rot
	Powdery Mildew
Foliar/Crown Disease:	Angular Leaf Spot
	Anthracnose
	Common Leaf Spot
	Powdery Mildew
	Leather Rot
Root/Crown Disease:	Anthracnose
	Phytophthora Root and Crown Rot, including Red Stele Root Rot
	Verticillium Wilt
	Black Root Rot

The use of good cultural practices is critical in the management of disease. These practices include field selection, raised beds, the use of certified stock, use of resistant cultivars, use of drip irrigation, the removal and destruction of dead leaves and fruit from strawberry plants, the use of plastic mulches to prevent berry-soil contact, good sanitation methods during harvest, packing, transport and storage, and crop rotation with a non susceptible crop.

Research related to soil solarization and hot water treatments is underway. Solarization is a technique in which heat generated by solar radiation on clear plastic covered moist soil kills soil-borne pathogens, nematodes, and weed seeds in the upper 2 to 6 inches of the soil. The technique appears to have more potential in central valley growing areas where solar radiation is highest and

the relatively long crop-free period required for solarization is consistent with the region's cultural schedules. Solarization may also be useful in other inland locations, but along the coast clouds, fog, or wind prevent adequate solar heating of the soil. Because solarization generated heat only penetrates 2-6" deep, it may need to be combined with other control methods, such as fumigation of the deeper soil profile. The effectiveness of fumigants, such as methyl isothiocyanate (whether generated from the use of Vapam, or from crop residues), may be increased when used in combination with soil solarization.

Hot water dipping of bare-root strawberry plants in nurseries can reduce nematodes and some diseases. This method, however, cannot be used for transplants intended for fruit production in fields because plant vigor is reduced substantially by the hot water treatment.

Chemical treatment begins with a pre-plant fumigation of the soil with methyl bromide and chloropicrin to reduce the inoculum of potentially serious strawberry diseases. This pre-plant fumigation also significantly increases yields and quality by impacting plant pathogens of unknown identity. Verticillium wilt and Phytophthora root rot are usually not problems in fields that have been fumigated properly. Pre-plant fumigation plays an important role in managing anthracnose and common leaf spot. Fumigation, however, does not kill all pathogen populations, so they will increase to levels sufficient to cause damage if pre-plant soil treatment is not repeated on a regular basis. Fungicides, such as benomyl, iprodione and vinclozolin to control above ground diseases (e.g.: anthracnose, powdery mildew, botrytis fruit rot), must be applied before infection occurs or when the disease just begins to develop. Resistance problems are a major concern when it comes to fungicides, so applications of these types of products are made when conditions indicate that control action is needed. Different types of products are usually applied when repeat applications are needed, to avoid resistance development.

INSECTS AND MITES. A variety of insect and mite pests occur in California strawberries, some are beneficial predators or parasites of insect pests, but others are destructive and can cause yield decreases and/or fruit grade reductions. The importance of mite and insect pests depends on the location, harvest season, market destination of the crop, and whether strawberry plants are held over for a second year of production. Insects and mites usually are damaging when their feeding kills plants or reduces the supply of nutrients available for fruit production. In some cases fruit quality is reduced by diminished size, contamination, scarring, or growth distortion. Insects

identified as pests of concern for the strawberry industry in California are listed below. Complete descriptions of each of these pests are found in Appendix 4 which is comprised of summaries developed by the UC Statewide Integrated Pest Management Project.

Aphids	Garden Tortrix
Beet Armyworm	Lygus Bugs
Cabbage Looper	Root Weevils
Corn Earworm	Saltmarsh Caterpillar
Cutworms	Twospotted Spider Mite
Cyclamen Mite	Western Flower Thrips
European Earwig	Whiteflies
Garden Symphylan	

Many insects and mites found in strawberry fields are beneficial predators or parasites that help suppress the pest populations. Predatory mites and parasitic wasps tend to attack only a single pest or a few types of pests, but can play an important role in keeping those pests under control. When pesticide applications are needed, products that are least harmful to the predatory insects are selected whenever possible.

Cultural practices are critical in controlling the insect population within a field. Many insects are attracted to weeds or debris, therefore, removal is necessary. Other cultural practices include field selection, avoiding second year plantings, pre-plant hot water bath for infested stock, sorting out contaminated berries. Recently, research on suction devices used to vacuum insects have been tried on lygus bugs with some success; however, there is concern that vacuums may increase existing problems with powdery mildew and gray mold. Solarization may be effective in controlling soil-dwelling arthropods, although more research is needed.

WEEDS. Strawberries are highly susceptible to weed competition immediately after planting when the plants are small and frequent watering provides ideal conditions for weed germination. Most weeds invading strawberry fields are annuals. Effective weed management in strawberries requires a combination of cultural practices, pre-plant soil fumigation, and additional herbicide applications. Appendix 5 encloses the UC Statewide Integrated Pest Management Project's summary of "Integrated Weed Management" for strawberries. The University of

California's publication, "Integrated Pest Management for Strawberries", also identifies and details the most important weed pests of strawberries in the different growing regions in California. A summary of their findings is as follows:

Central Coast	Santa Maria Valley	Oxnard Plain	South Coast	Interior Valleys	No. California Nurseries
little mallow burclover common groundsel sowthistle purslane chickweed filaree burning nettle bluegrass	little mallow burclover chickweed filaree	little mallow burclover shepherd's purse chickweed burning nettle	mallow sweet clover filaree lambsquarter pigweed shepherd's purse	barnyardgrass pigweed lambsquarter purslane sowthistle cudweed horseweed hairy fleabane crabgrass shepherd's purse	mallow sweetclover filaree vetch sowthistle

It is critical to keep weeds from getting established and out competing the young strawberry plants. Thorough hand weeding is labor intensive and expensive but is an alternative to chemical treatment. Other cultural practices include field selection, crop rotation and the use of opaque mulches, or IR selective films. Opaque polyethylene mulch greatly reduces weed growth in planting beds, however, it delays fruit production and can burn fruit when temperatures are above 90°F. Solarization is being researched as an alternative to pre-plant fumigation. It can be effective in areas where strong sunlight and high air temperature allow soil heating to a sufficient temperature to kill weed seeds and shallow growing perennials, such as bermuda grass rhizomes and nutsedge tubers.

Chemical weed treatment typically consists of a broad spectrum pre-plant fumigation containing methyl bromide. Even with pre-plant fumigation, windblown seeds resulting in weeds present a considerable problem to the strawberry grower. Herbicides, such as paraquat, DCPA, and sethoxydim may play a role in managing weeds within a field; however, to avoid phytotoxic effects to the strawberry plants care must be taken in the application of such products.

NEMATODES. Damage from nematodes may result in plant stress and reductions in yield. Plant parasitic nematodes are microscopic, unsegmented roundworms that may be found in

the soil, as a parasite in roots, or aboveground on plant parts. The use of certified stock (produced in fumigated fields) combined with pre-plant fumigation with methyl bromide has been the primary management technique to date. The most common nematodes identified as pests in California strawberry fields are detailed in the UC Pest Management Guidelines (Appendix 6). The most common nematode pests are the following:

Foliar Nematode

Northern Root Knot Nematode.

Steps are taken by the strawberry industry to reduce the chance of nematode infestation. These practices include selecting tolerant cultivars and certified nursery stock, by analyzing field samples, and by taking steps to clean equipment to prevent the transfer of nematodes from an infested field to a clean field. Other cultural practices include planting when conditions are unfavorable for nematodes, crop rotation including fallow, and biological control.

Chemical treatment of nematodes begins with pre-plant soil fumigation with methyl bromide. Pre-plant applications may also be made with metam sodium, although steps must be taken in the application method to insure that this material get to the target organism. Oxamyl is registered for use on root knot and lesion nematodes on nonbearing nursery stock only, although some incidence of phytotoxicity has been reported for certain cultivars. 1,3-D (Telone II or Telone C35) has been demonstrated to be very effective against nematodes, but is not typically used by growers in California at this time due to severe restrictions related to the use of the products near urban areas (e.g.: rate restrictions near townships and buffer zones).

III. PEST MANAGEMENT ACTIVITIES AND PRACTICES:

California's strawberry industry relies on a combination of approaches to pest control. Biological control, cultural practices, pre-plant fumigation and chemical treatments are each components of the current pest management program. While cultural practices and biological controls are important facets of the pest management program, these non-chemical practices alone would not allow California growers to continue producing high quality fruit at a sufficient yield to remain both competitive and economically viable. The industry has relied on pre-plant fumigation with methyl bromide, in combination with chloropicrin, to control soil borne diseases, prevent weed germination, and to kill arthropods present in the soil. This broad spectrum fumigant has been used

in conjunction with cultural practices and biological control to provide a strong first defense in the control of pests common to strawberries. After planting, growers continue to utilize biological controls, such as natural predators, and cultural practices, such as field sanitation techniques to minimize the need for chemical treatments. However, it is in large part the use of chemical treatments, such as methyl bromide, that has resulted in relative economic stability for the California strawberry industry.

PRE-PLANT FUMIGATION. Pre-plant fumigation with Methyl bromide, used in combination with chloropicrin, is used throughout all of California's growing regions on almost all strawberry fields as well as in all nurseries during their propagation of planting strawberry stock. No single synthetic chemical or non-chemical option or any combination of practices and procedures has been found that can replace the efficacy of methyl bromide/chloropicrin broad-spectrum applications. The methyl bromide/chloropicrin pre-plant fumigation combination has proven efficacious for the following pests, as reported by the UCD Integrated Pest Management Program:

Arthropods: Root weevils, cutworms, strawberry rootworm, white grubs, garden symphylan, ground mealybug.

Diseases: Soil borne fungi that cause verticillium wilt, Phytophthora root and crown rots, anthracnose, black root rot, charcoal rot, and other soil-borne pathogens of unknown etiology that impact strawberry plant yield and quality.

Nematodes: Foliar nematode, Root-knot nematodes

Weeds: Seeds in all species except field bindweed, little mallow, burclover, sweetclovers and filaree.

OTHER TREATMENTS. Treatments with fungicides, insecticides and herbicides are applied to fields based on existing, increasing or potential pest pressures. Many diseases overwinter in fields, which is why pre-plant treatment with methyl bromide is important to control disease pressure. Appendix 1 is a table summarizing non-chemical and chemical treatments used by the strawberry industry as taken from information available from the UC IPM Program, the DPR

Survey and input from Pest Control Advisors.

Diseases, such as anthracnose which develops under warm or cool moist conditions, and Botrytis fruit rot (gray mold) which is prevalent in cool weather, can significantly reduce fruit yield. Captan and Benomyl are most commonly used by growers as a preventative treatment to control the outbreak of anthracnose. Repetitive treatments of vinclozolin, iprodione, Captan or thiram are used to treat Botrytis fruit rot, a major fruit rot disease of California strawberries. Pest resistance to fungicides is a common problem that must be faced by growers utilizing chemical. Growers alternate chemicals, such as iprodione and vinclozolin with other products to minimize the potential for pest resistance.

Damage to strawberry plants and fruits from insects can be significant to growers throughout the state. Two-spotted spider mites and lygus bugs are two pests that can severely impact the quality and yield of strawberries. Damage from two-spotted mites to strawberry plants is heaviest during the first four months following planting and is seen as stippling, scarring and bronzing of the leaves and calyx. Avermectin is very effective in controlling two-spotted mites, but is expensive and requires multiple treatment. Other products registered for use, such as dicofol, febutatin oxide and potash soap, all have disadvantages including pest resistance, variable efficacy and phytotoxicity under certain conditions. Pest resistance to dicofol has been seen, which makes growers reluctant to use this product against two-spotted spider mites because it is one of the few products effective against cyclamen mite, and they would prefer to use this tool when it is needed for that pest.

Lygus bugs are a serious pest in the central and south coast growing regions, damaging seeds causing irregularly shaped strawberries. Lygus bugs are only susceptible to chemical treatments during the first or second instars. Growers commonly apply naled, malathion and methomyl to control young nymphs.

BIOLOGICAL CONTROLS. Biological Control is defined as the activity of any organism (parasite, predator, pathogen, antagonist, or competitor) that keeps a pest or pathogen population lower than it would otherwise exist. These organisms may be used to prevent infection or as colonists of the infected tissues to arrest pest or disease development.

Natural Enemies. Natural enemies contribute to the control of many insect and mite pests of strawberries.

NATURAL ENEMIES OF STRAWBERRY PESTS IN CALIFORNIA	
Pest	Biological Control Agent
Two-spotted spider mite	Predatory mites: <i>Phytoseiulus persimilis</i> , <i>Galendromus (metaseiulus) occidentalis</i> , <i>Amblyseius (neoseiulus) californicus</i> ; six-spotted thrips; spider mite destroyers; minute pirate bugs; bigeyed bugs; lacewings, dusty wings, damsel bugs, predatory midges
Lygus bug	Parasitic wasps: <i>Anaphes iole</i> (<i>A. ovijentatus</i>), <i>Leiothrips uniformis</i> ; bigeyed bugs; damsel bugs; minute pirate bugs; spiders
Cyclamen mite	Predatory mites: <i>Amblyseius (neoseiulus) aurescens</i> , <i>A. (N.) cucumeris</i> , <i>Galendromus (Metaseiulus) occidentalis</i> ; six-spotted thrips, minute pirate bugs
Aphids	Parasitic wasps: <i>Lysiphlebus testaceipes</i> , <i>Aphidius</i> , <i>Aphelinus</i> ; fungal disease: <i>Entomophthora</i> ; lacewings; bigeyed bugs; minute pirate bugs; dusty wings; damsel bugs, lady beetles
Caterpillar pests	Parasitic wasps: <i>Trichogramma</i> , <i>Macrocentrus</i> , <i>Hyposoter</i> , <i>Copidosoma</i> , damsel bugs; bigeyed bugs; lacewings; minute pirate bugs; nuclear polyhedrosis virus
Whiteflies	Parasitic wasps: <i>Encarsia</i> , bigeyed bugs; minute pirate bugs; lacewings

When evaluating needed pest control measures, the pest control adviser and the grower try to maximize the benefits of biological controls whenever possible, turning to chemical treatments when pest populations are no longer managed by biological controls or are expected to increase and cause significant crop damage. When treatments are necessary, growers give consideration to the beneficial insects and mites and select products carefully in an attempt to maintain as high a population of these beneficial biological control agents as possible.

CULTURAL CONTROLS. Good cultural practices, from field selection through handling of harvested fruit are essential to all growers for maximum yield of high-quality California strawberries. Many cultural practices have a significant effect on pest control. The following is a brief discussion of cultural practices common to most growers.

Field Selection. Deep, well-draining, sandy loam soils are best for strawberry production. The field should be easy to grade and have good air drainage so that cold air doesn't settle on the field. An adequate supply of good-quality water should be nearby. Soils are tested for salinity, and records of previous crops and herbicide use are reviewed.

Cultivar Selection. Strawberry cultivars are developed based on several factors including desired day length, and vigor. Cultivars vary in their susceptibility to some pests and abiotic disorders. Shifts in cultivar selection by growers has occurred in recent years. Central coast strawberry producers have shifted from exclusively summer-planting short-day cultivars (i.e. Tioga, Aiko, Tufts, Douglas and Pajaro) to primarily fall-transplanting the day-neutral cultivar "Selva. During the 1980's southern California strawberry producers shifted from later October or early November cultivars to early October transplanting of "Chandler", which was recently replaced by "Camerosa". The University of California's publication, "Integrated Pest Management for Strawberries" describes the characteristics of strawberry cultivars commonly grown in California as follows.

CULTIVAR	DAY LENGTH	PLANTING SEASON	COMMENTS & POTENTIAL PROBLEMS
Chandler	short	winter summer	somewhat tender skin
Douglas	short	winter	early production, potential for albino fruit, soft fruit in warm weather
Irvine	neutral	winter	early production; more susceptible to mites if vigor inadequate; more susceptible than short-day plants to powdery mildew
Muir	neutral	winter summer	more susceptible to mites if vigor inadequate; more susceptible than short-day plants to powdery mildew
Oso Grande	short	winter	albino fruit, splitting
Pajaro	short	summer	long season; susceptible to rain damage
Parker	short	winter	early production; susceptible to weather damage
Seascape	neutral	winter summer	more susceptible to mites if vigor inadequate; more susceptible than short-day plants to powdery mildew
Selva	neutral	winter summer	more susceptible to mites if vigor inadequate; more susceptible than short-day plants to powdery mildew

Sanitation. To help keep a field free of pathogens, soil-dwelling insects and weeds, growers utilize the following sanitation practices in addition to soil fumigation:

- use high-quality, certified pathogen-free transplants
- allow time between crops so that crowns from the previous strawberry crop are completely decomposed
- work cleanest fields first rinsing equipment with plain (hot) water to remove soil and plant debris before working another field,
- remove weeds from in and around the field before they produce seed
- ensure that manure or other organic amendments added to the field are properly composted or sterilized.

Crop Rotation. Strawberry fields are sometimes rotated with a cover crop, such as rye or barley, or with another cash crop, such as beans or broccoli, to reduce pest populations and improve soil structure. In areas where land costs are high, such as the south and central coast, planting non-cash cover crops are not economically feasible. Cash-crop rotation needs time to be effective, and the crop rotated into the field is often not as profitable as strawberries resulting in economic loss to the grower. Growers are sometimes reluctant to rotate crops because the value of the land is so high that a high value crop, like strawberries, is necessary to offset land and farming costs, or because they do not possess sufficient land to rotate crops. In addition, some soil-borne pests can survive for years in the soil which could reduce the success of a crop rotation program.

Cultural Practices and Field Preparation. Decisions related to various cultural practices are made daily by growers. Decisions related to field selection, soil nutrient supplements, and cultivars are made well in advance of planting. The growers design planting beds to allow proper drainage and irrigation. Time is allowed from one crop to another to allow any residues from previous treatment to decompose. Soil supplements and nutrients are added to fields to prepare soil for planting and sustaining crop. These are practices common to all growers. Clean tillage, raised beds, plastic mulches and water management are all important aspects of a systems approach practiced by California strawberry growers.

SYSTEMS APPROACHES. The California strawberry industry currently practices a pest management strategy that encompasses cultural, biological and chemical components. Cultural practices, such as field selection and preparation, use of certified plant stock, good soil preparation, bed design, field sanitation and crop rotation are critical components of the strawberry Industry's current and future pest management system. This system could reduce the need for conventional pesticides and/or lead to reduced rates of chemical treatment in the field.

IV. REVIEW OF PEST MANAGEMENT OPTIONS BEING CONSIDERED THAT MEET REDUCED-RISK OBJECTIVES:

Methyl bromide, a key component in California's strawberry industry pest management programs, has been determined to contribute to ozone depletion and will no longer be produced after 2001. As discussed in the previous sections, methyl bromide is a broad spectrum soil fumigant, and no other chemical or non-chemical tool has been identified that will replace it fully. The strawberry industry is currently researching new practices, both cultural and chemical, to identify effective reduced-risk pest management programs that will be able to replace the industry's use of methyl bromide. California's strawberry industry recognizes the need to become less reliant upon chemical treatments and to develop sound practices that will enhance pest control with as little chemical treatment as possible, yet maintaining fruit quality and yield. The industry's goal is to develop a pest management program that will encompass cultural, biological and chemical treatments to provide growers with the safest possible tools for continued economic success in the market. Due to the potential adverse impacts of methyl bromide on the environment and public health, the adoption of any pest management tool or program designed to substitute for the current reliance on methyl bromide would result in significantly reduced-risk.

The California Strawberry Commission together with experts from the United States Department of Agriculture, the University of California, and California's Integrated Waste Management Board have examined existing and new treatments that could reduce risks to workers, growers, the general public, and the overall environment. These reduced risk components of the pest management system focus on cultural practices and application techniques. These components are the focus of the accompanying Pest Management Alliance Work Plan.

1. **Soil Solarization** - This technique involves covering moist soil with clear plastic and allowing the solar radiation to heat the top 2 to 6 inches of soil to temperatures high enough to kill soil-borne pathogens, nematodes and weed seeds. Solarization is seen as a potential alternative to soil fumigation or as a supplement to fumigation thus allowing lower use rates for fumigants. Solarization has the greatest potential for use in the central valley growing areas, where solar radiation is highest; although there may also be a potential for use in inland locations along the central coast where clouds, fog or winds do not prevent solar radiation from adequately heating the soil. Additional research is needed to define the conditions under which solarization will contribute to the pest management program and, if proven to be consistently effective, to educate the grower community to the benefits of solarization.
2. **Crop Rotation** - Crop rotation can be an effective method in suppression of disease and/or pests to annual crops. Strawberry fields are rotated with a cover crop, such as rye, barley and bell beans, or cash crops such as broccoli to enhance pest control and help improve soil structure. Cover crops enhance the health of the soil and can help suppress disease, but represent an economic loss to the grower. Crop rotation needs time to be developed into an effective pest management tool. The crop rotated into the field is often not as profitable as strawberries resulting in relative economic loss to the grower. Factors such as economic impact, disease control, and pesticide label restrictions need to be researched and optimal parameters established in the development of this method of pest management.
3. **Organic Amendments/Mulching**. Organic amendments can be incorporated into the soil to improve the quality of the soil, and can be used on the soil surface to provide a barrier to help keep fumigants from escaping. With the help and guidance of the expertise within the California Integrated Waste Management Board, the California strawberry industry proposes to investigate the impacts of utilizing organic amendments or mulches from various specific waste streams established by the Board's authority on pest control. This use of California's unique, statewide waste management to focus on possible reduced-risk alternates to pesticides, is an innovative use of our state's resources.

4. **Reduced-Risk Application Methods.** With the assistance of our team members, several alternate application technologies are being proposed to dramatically reduce the potential harms from any future use of soil-borne pest controls. The following techniques are being evaluated:

- **Sub-Surface Drip Irrigation Systems.** Potential exposures and fumigant releases resulting from direct injection of pesticides could be significantly reduced through the use of sub-surface drip irrigation systems. The treatments being considered in this reduced-risk alternate to existing delivery techniques are:

- **Telone C35 EC.** 1,3-D is almost as effective as methyl bromide as a broad-spectrum fumigant. It is not, however, used by most California growers due to restrictions associated with amounts allowed/township and buffer zones. A new emulsifiable concentrate formulation, not currently registered for use in California, when applied via sub-surface drip irrigation shows great promise in the control of air emission and efficacy and may allow for future use of this effective tool. Preliminary research in Texas has indicated that applications of the EC formulation through drip irrigation effectively controls air contamination reducing potential risk and exposure to applicators, growers and the public. More research under California conditions is needed to determine if this is a viable tool that could bridge the gap left by the loss of methyl bromide, while new pest management practices are proven effective and are made available to the California strawberry industry.
- **Biological Control Agents.** Biological control agents are typically water suspendable and application via sub-surface drip irrigation systems may be a practical way to deliver these agents to the field. Research on biological control agents is new and more will have to be known about the efficacy of individual agents before field applications are made.
- **Chloropicrin and Vapam.** These traditional pesticides may also benefit from solubilization in water and sub-surface drip irrigation delivery systems..

- **High-Barrier Films.** These high barrier films which are essentially impermeable to the crop protection chemicals being used trap the soil-applied fumigant until it degrades, thereby reducing the emission from the fumigant, and may allow for reduced application rates of the fumigants since the material is held longer in the soil.
- **Chemical and Organic Barriers.** These chemical or organic barriers are supplements to plastic barriers and may be the pragmatic means to significantly reduce the potential risks of soil applied products.
- **Soil Conditions.** Experimentation is underway to identify the optimal soil conditions for reducing emissions and other potential hazards associated with treatments of soil-borne pests.
- **Application Rates.** Research is being performed to enhance the industry's understanding of the minimal rates needed for agronomic efficacy.

V. PEST MANAGEMENT CHALLENGES:

The California strawberry industry has achieved relative economic stability in recent years, with an estimated annual crop value of \$580 million dollars, due in part to current pest management practices which rely heavily on the use of methyl bromide/chloropicrin treatments to control soil borne diseases, insects, and weeds. The problem facing the industry today is the impending loss of methyl bromide in 2001, a key component of the current pest management system. The industry faces the primary challenge of developing an effective, viable pest management program that will promote continued economic stability for the California strawberry industry.

The industry is developing a long-term pest management program that will couple reduced-risk chemical treatments with cultural practices, such as the use of high barrier films and solarization to achieve pest control. Efforts to determine the effectiveness and viability of these approaches is underway, although it could be several years before these pest control techniques become common cultural practices.

For the California strawberry industry to maintain an economically viable level of

production, it must face the short term challenge of finding a reasonably effective reduced-risk chemical treatment program that will not harm the ozone, threaten worker or public health, and will allow for the continued production of quality fruit. The long-term challenge faced by the industry is the development of a systems approach that can reduce the industry's use of and dependence on chemical treatments (by reducing rates of application, and/or the need for treatments) and increase the industry's reliance on reliable cultural practices, such as high barrier films, solarization, organic soil amendments, and crop rotation, used either alone or as a supplement to reduced-rate chemical treatments. Research to determine the efficacy of reduced risk chemical treatments (e.g.: sub-surface drip irrigation techniques) and cultural practices, alone and in combination are needed before these practices can be recommended to and implemented by growers.

Grower dependence on methyl bromide/chloropicrin is high, as there are currently no other broad-spectrum soil fumigant options available to the strawberry industry. The need for an efficacious control program to replace methyl bromide is critical to the industry. Challenges facing the industry include the identification of effective reduced-risk chemical treatments, the development of viable cultural controls, and grower acceptance and implementation of new practices.

The strawberry industry has reviewed both chemical treatments alone and in combination with cultural practices that have the potential to replace methyl bromide after it has been phased out, and has developed a work plan to address the industry's future needs for effective, economical chemical and non-chemical tools.

Reduced Risk Chemical Treatments. Methyl bromide is a toxic air contaminant that is a Toxicity Category I pesticide bearing the signal word "DANGER". It is a colorless, odorless gas that can potentially cause respiratory distress, cardiac arrest and central nervous system effects. It is highly regulated, restricted-use pesticide that can only be applied by teams of certified applicators. One pesticide that is an effective alternative to methyl bromide is 1,3-D . 1,3-D is currently registered as a restricted-use pesticide (Telone II, Telone C35) that is highly regulated and also identified as a toxic air contaminant in California. Use of 1,3-D in California is currently limited to 47,500 lbs of active ingredient (approximately 5,000 gallons of Telone II) per township per year due to concern with air quality impacts. A second use limitation for 1,3-D is the 300 foot buffer zone required from any occupied residence. Most strawberry fields are located in heavily populated areas and growers using 1,3-D are subject to these restrictions. Because of these limitations, growers do not typically apply 1,3-D to strawberry fields.

Dow AgroSciences has recently developed an emulsifiable concentrate formulation, Telone C35 EC, that can be applied through a closed system sub-surface drip irrigation system into fields. Telone C35 EC is not currently registered in California, but results of research conducted by the University of California to test the efficacy of the product when delivered via closed system irrigation have been promising. Closed-system delivery via sub-surface drip irrigation reduces potential air contamination, exposure to workers and to the public, and may result in reduced rate applications. This type of delivery system could address the 1,3-D use limitations that currently discourage growers from using this effective tool.

Reduced Risk Pesticide Use in Conjunction With Certain Cultural Practices. Certain cultural practices, when applied in conjunction with chemical treatments can result in reduced chemical application rates, reduced air emissions and reduced exposure potential to workers, the public and the environment. Research is still needed to determine the efficacy of Telone C35 EC when applied at full and reduced rates via a closed system drip irrigation system. Data is also needed to determine if the use of certain cultural practices, such as the use of high barrier film, crop rotation, organic supplements or supplemental solarization will sustain the product's efficacy at reduced application rates.

VI. INNOVATIONS COMPARED TO EXISTING PEST MANAGEMENT SYSTEMS:

The current pest management system utilized by the strawberry industry includes cultural practices, biological controls and chemical treatment. A key existing component of the industry's pest management systems is pre-plant fumigation with methyl bromide/chloropicrin. This combination is used to control soil-borne diseases, nematodes, arthropods that are present in the soil, and prevent weed germination of many important weed species. Since methyl bromide will no longer be available to strawberry growers after 2001, the industry must look at new, innovative approaches to replace this important chemical tool.

For many years, the California strawberry industry has had economic success in great part because of the broad-spectrum efficacy of the pre-plant fumigant, methyl bromide. Innovative techniques are being considered as long term fundamental components of a systems approach for pest control for the strawberry industry. These practices may result in reduced pesticide application rates and possibly fewer needed applications. Research in these areas is innovative because these

methods of pest control are just now emerging as potential tools for the industry. These innovative and potential tools are described briefly as follows:

- **Sub-Surface Drip Irrigation Systems.** Significant reduction of potential exposures and fumigant releases resulting from direct injection of pesticides can potential be achieved through the use of sub-surface drip irrigation systems. Drip irrigation lines are placed under the surface of the soil where applications of water soluble products are applied directly into the soil. The soil helps trap the chemical material allowing for less emission and therefore risk, and prolonged soil contact and therefore increased efficacy of the product.
- **High-Barrier Films.** These high barrier films entrap the soil-applied product until it degrades, thereby reducing the emission from the chemical or fumigant, and allowing for reduced application rates since the material is held longer in the soil.
- **Chemical and Organic Barriers.** These chemical or organic barriers are supplements to plastic barriers and may be the pragmatic means to significantly reducing the potential risks of soil applied products.
- **Soil Conditions.** Experimentation is underway to identify the optimal soil conditions for reducing emissions and other potential hazards associated with treatments of soil-borne pests.

VII. POTENTIAL BARRIERS TO PROPOSED REDUCED-RISK METHODS:

The California strawberry industry must find viable alternatives, whether chemical or cultural, to the use of methyl bromide or it will face devastating economic impact. Potential barriers to the proposed reduced-risk methods include time, and funding.

The California strawberry industry must develop a viable pest management program that will replace the use of methyl bromide by 2001. Without a viable pest management program, the industry will face significant economic losses. Because there is little time, the industry must focus on the most promising short term solutions to fill the gap that will be left when methyl bromide is

no longer a pest management tool available to the industry. The most promising short term solutions are those that have been presented in the Pest Management Work Plan and have been discussed in this document.

The Pest Management Work Plan proposes a multi-faceted systems approach including research on sub-surface drip irrigation, solarization, high barrier films, crop rotation, and organic amendments/mulching. Experts experienced in each of these areas will be conducting the proposed research if funding is available. To date, matching funds have been committed to this research by the USDA, the California Integrated Waste Management Board, the University of California and the California Strawberry Commission. The PMA funding would allow for research to be expanded (sub-surface drip irrigation and solarization), while projects identified for future funding (organic mulching and high barrier films) could be done this year. Results of these studies and efficacy of the trials, would of course dictate implementation strategies.

VIII. CONCLUSIONS:

The strawberry industry has relied upon methyl bromide as a key tool in its pest management program. By the year 2001, the industry must develop an effective and viable program that will allow California growers to continue leading the nation in strawberry production. To be successful, this program will need to encompass all aspects of pest management, including cultural and chemical practices. New reduced-risk practices, such as soil solarization, crop rotation and reduced rate application methods, will be key components to a successful pest management system. Innovative research related to the treatment of soil-borne pathogens is critical to the continued success of the strawberry industry.

IX. REFERENCES:

Braun, A. and Supkoff, D. Options to Methyl Bromide for the Control of Soil-Borne Diseases and Pests in California. July 1994. California Department of Pesticide Regulation. (<http://www.cdpr.ca.gov/docs/dprdocs>).

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Management for Strawberries. 1994. University of California.

Statewide Integrated Pest Management Project, University of California. UC Pest Management Guidelines. University of California (<http://www.ipm.ucdavis.edu>).

X. APPENDICES:

1. California Strawberry Commission Pest Management Evaluation Guideline.
2. Survey: Major Pests and Their Methods of Control in Strawberries in California.
3. UC Pest Management Guidelines - Pest Diseases
4. UC Pest Management Guidelines - Insects
5. UC Pest Management Guidelines - Integrated Weed Management
6. UC Pest Management Guidelines - Nematodes

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APPENDIX 1

CALIFORNIA STRAWBERRY COMMISSION Pest Management Evaluation Guide Information in this table was compiled from the UC IPM Project crop/pest profiles, results of the Pest Management Survey Database developed by DPR, the UC IPM Project and Pest Control Advisors.						
PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre ²	Comments
DISEASES						
Angular Leaf Spot	Clean plant stock. Avoid overhead irrigation when possible		Pest reduces plant growth and fruit reducing yield by 10-20% during winter.	Fixed Coppers Methyl Bromide/ chloropicrin	300-400 lbs	Repeated applications may be phytotoxic to plants. Preplant fumigation needed before next planting to kill disease left in soil from previous infected plants.
Anthracnose	Clean plant stock. Drip or furrow irrigation.		Pest can reduce yield by 50%.	Benomyl plus Captan 50 WP Iprodione	1 lb 4 lbs Label rates	Preventative fungicide treatments. Restricted Use Material.

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT ¹		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre ²	Comments
Botrytis Fruit Rot		Remove and destroy dead leaves and infected fruit. Plastic mulches prevent berry-soil contact.		Anilazine	Label rates	REI: 4 days. Potential resistance problems. Benomyl is rarely recommended by PCAs. Max use 4 times per season. Variable efficacy. Max use 4 times per season. Commonly recommended by PCAs. REI: 4 days. Commonly recommended by PCAs. Commonly recommended by PCAs. Tank mix with fungicide of different chemistry (Captan, thiram) to reduce resistance problems. Resistance: To benomyl, iprodione, and vinclozolin. Alternate materials with different products.
				Benomyl plus Captan 50 WP	1 lb 4 lbs	
				Vinclozolin	1.5 lbs	
				Iprodione (Rovral)	1.5 lbs	
				Captan 50 WP	4 lbs	
				Thiram	Label rates	
				Thiophanate-Methyl	0.75-1.0 lb	
Common Leaf Spot (significant economic impact)		Use resistant cultivars, and clean stock. Remove infected leaves. Drip irrigation.		Methyl Bromide/Chloropicrin	300-400 lb	Pre-plant fumigation needed to kill overwintering disease. For Nursery Use Only (non-bearing strawberries). Variable effectiveness.
				Chlorothalonil	2.0-2.75 pt	
				Benomyl	Label rates	
				Copper hydroxide	Label rates	

PES:	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT ¹		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre ²	Comments
Leather Rot		Avoid infested fields.		Methyl Bromide/ Chloropicrin	300-400 lbs	Preplant fumigation.
		Remove diseased fruit.	Additional research needed.	Metalaxyl (Ridomil 2E)	Label rates	Do not use more than 6 qts/acre/year. Cost is prohibitive.
		Plastic mulches.	Additional research needed.			
		Drip irrigation.				
Mucor Fruit Rot		Remove plant debris.		Iprodione	1.5 lb	
		Remove all ripe fruit.		Vinclozolin	1.5 lb	
		Practice good sanitation during harvest, packing, transport and storage.		Captan 50 WP	1 - 4 lb	REI: 4 days.
Phytophthora Root and Crown Rot		Raised beds.		Methyl Bromide/ Chloropicrin	300-400 lbs	Preplant fumigant.
		Drip irrigation.				
		Use resistant cultivars and clean stock.		Metalaxyl	Label Rates	Variable efficacy. Limited to 3 applications/ /crop/year.
		Plant in noninfested fields with good drainage.				
Powdery Mildew		Avoid overhead irrigation.		Sulfur	2.5 - 5.0 lbs	Application during high temperatures may burn foliage. Requires multiple treatments.
		Use resistant cultivars.		Myclobutanil (Rally 40W)	2.5 - 5.0 lbs	PHI: 3 days. Apply in min. of 50 gal/acre. Sec. 18. Requires multiple treatments.
		Use clean stock.		Insecticidal Soap	2.5 oz/gal	PHI: 0 days. Not for use on new transplants, unrooted cuttings, or water-stressed plants.

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre ²	Comments
Red Stele		<p>Use resistant cultivars and clean stock.</p> <p>Raised beds.</p> <p>Drip irrigation.</p> <p>Keep soil pH at 7 or more.</p>		Methyl Bromide/ Chloropicrin Methalaxyl	<p>300-400 lb.</p> <p>Label Rates</p>	<p>Preplant fumigant. Only known control which is effective against disease.</p> <p>Variable efficacy. Limited to 3 applications/crop/year.</p>
Rhizopus Fruit Rot		<p>Field sanitation.</p> <p>Remove plant debris.</p> <p>Use resistant cultivars (those with thick cuticles).</p>	Only known control which is effective against pest.			Typically does not cause excessive damage. Fungicide treatment is generally not recommended.
Verticillium Wilt		<p>Avoid infested fields.</p> <p>Use resistant cultivars and clean stock.</p> <p>Drip irrigation.</p> <p>Crop rotation with nonsusceptible crop.</p> <p>Avoid high nitrogen fertilizers.</p>		<p>Methyl Bromide/ Chloropicrin</p> <p>Methyl isothiocyanate</p> <p>Metam Sodium</p>	<p>300-400 lb</p> <p>Label Rates</p> <p>Label Rates</p>	<p>Preplant fumigant. Kills beneficials and other non-target organisms.</p> <p>Preplant soil drench. Variable efficacy.</p> <p>Variable efficacy.</p>
Other, Unknown Etiology						

PES.	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre ²	Comments
INSECTS AND MITES						
Aphids: Strawberry Aphid Melon Aphid Green Peach Aphid Potato Aphid	Predators: syrphid; or green lacewing larvae.	Row covers, plastic tunnels or Remay-type enclosures. Control dust to facilitate parasite and predator activity.	Random sampling. Treat chemically if infestation level reaches 30%. Natural predators are useful, but often appears too late in season.	Diazinon	1 lb	PHI: 5 days. Apply in 100 gal water/acre. May injure mite predators. Should be used with other control tactics. Not the treatment of choice.
				Insecticidal Soap	2.5 oz/gal	Apply in 100 gal water/acre. Possibly phytotoxic. Discolors fruit on repeat applications. Will kill approx. 50% of beneficial predatory mite eggs. Rarely used.
				Azadirachtin	Label rates	Additional research needed.
				Malathion	Lowest label rate	Most common treatment, but requires multiple applications.
Beet Armyworm	Natural parasite: Hyposoter exigua	Weed control.	Monitor natural parasite population to determine if armyworms will be controlled by natural enemies. More research needed. Elimination of weed hosts should be used in conjunction with another tactic.	Naled	Label rates	Kills beneficial and non-target organisms. Rarely recommended by PCAs.
				Bacillus Thuringiensis (Javein) WG (Dipel) 2X	1-1.25 lb 0.5-2 lb	Variable Efficacy. Requires multiple treatments. PHI: 0 days
				Chlorpyrifos	Label rates	PHI: 0 days. Kills beneficials and non-target organisms.
				Diazinon	Label rates	
				Endosulfan	Label rates	
				Methomyl	Label rates	Kills beneficials and non-target organisms. May be used as last resort at end of season.

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT*	
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre*
Cabbage Looper	Parasitic wasps: Hypoaster exiguae; Coplidosoma truncatellum; Trichogramma Diseases: Nuclear polyhedrosis virus	Do not plant next to lettuce fields.	Additional research needed on biological control. Effectiveness dependent upon chemical treatment program.	Bacillus Thuringiensis (Dipel) 2X (Javelin) WG Chlorpyrifos	0.5-1 lb 0.25-0.5 lb Label rates
	Parasitic wasps: Trichogramma pretiosum Predators: Minute pirate Bug	Plant early maturing sweet corn cultivar around fields.	Biocontrol agents provide some suppression; however, the very low tolerance for insect contamination makes this control less effective. Sweet corn diversion planting should be used in conjunction with another tactic.	Methomyl Lannate LV Lannate Chlorpyrifos Bacillus Thuringiensis	2-3 pts 1 lb Label rates Label rates
Cutworms		Weed control. Avoid 2nd year plantings.		Bacillus Thuringiensis (Dipel) 2x (Javelin) WG Carbaryl (Sevin 5% Bait) Chloropicrin Diazinon Methyl Bromide	0.5-1 lb 0.5-1 lb 40 lbs Label rates Label rates Label rates
					Variable efficacy. Requires multiple applications. PHI: 1 day. Effective. Effective. Used after planting at low cost. Kills beneficial and non-target organisms. Worker safety issues.

PES.	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT ¹		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre ²	Comments
Cyclamen Mite	Predator Mites: Typhlodromus bellinus T. reticulatus Natural enemy: Striped thrips	Clean stock.	Use in conjunction with another treatment.	Avermectin	Label rates	More expensive. Temperature/season dependent.
		Pre-plant hot water bath for infested stock.	Variable effectiveness.	Dicofol (Kelthane) 35 WP	Label rates	PHI: 2 days. Variable effectiveness. Potential resistance problems.
		Avoid 2nd year plantings in problem areas.	More expensive. Must be used in conjunction with another treatment.	Endosulfan (Thiodan) 3EC	Label rates	PHI: 4 days. Variable effectiveness. Potential groundwater contamination.
		Destroy rubbish near field.		Propargite	Label rates	Potential phytotoxicity
European Earwig		Destroy rubbish near field.	Expensive.	Carbaryl (Sevin 5% bait)	40 lbs	
Fruit Fly		Completely remove ripe ~ fruit from plants.		Pyrethrin (Py-rin)	4-20 oz	
		Shorten harvest intervals when temperatures increase.		Pyrethrin plus Piperonyl Butoxide (Py-rin 60-6) EC	2-16 oz	
Garden Symphylian		Good sanitation in and around field.	Additional research is needed.			
		Remove cull piles and other nearby rotting fruit.				
		Continuous flooding for 3 weeks in summer.	Additional research is needed.			
		Discing in sorghum.				

Pest	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre ²	Comments
Garden Tortrix		Remove accumulated trash in Spring. Sort out contaminated berries. Avoid 2nd year plantings.	Significant labor needed. Significant labor needed. Expensive.	Bacillus Thuringiensis (Dipel) 2X	0.5-1 lb	PHI: 0 days.
Lygus Bugs	<u>Predators:</u> Bigeyed bugs Damselfly bugs Minute pirate bugs spiders	Weed control along roadways, ditches and field borders. Mow or disc under cover crop when lygus are still in nymphal stages. Bug vacuums.	Variable efficacy. Must be used in conjunction with another tactic. Vacuuming may increase problems with powdery mildew and gray mold.	Naled (Dibron) 8 EC Malathion 5EC 25WP Methomyl Lannate Lannate LV Insecticidal Soap M-Peds Diazinon Methyl Bromide Petroleum Distillates, aromatic Pyrethrins	1 pt. 1.5-3 pts 6 lbs 1 lb 3 pt 2.5 oz/gal water Label rates Label rates Label rates Label rates	PHI: 1 day. Kills beneficial and non-target organisms. Ineffective on certain species. PHI: 3 days. Variable effectiveness. Requires multiple treatments. Short or no residual. PHI: 3 days (fresh), 10 days (processing). Variable effectiveness. Requires multiple treatments. Kills beneficials and non-target organisms. Requires multiple treatments. Variable effectiveness. Must be used in conjunction with another tactic. Variable effectiveness. Variable effectiveness. More expensive. Lower yield, lower grade.

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre ²	Comments
Western Flower Thrips	Predator: Minute pirate bugs		Minute pirate bugs feed on thrips, but thrips feed on two-spotted spider and cyclamen mites. Control is not usually necessary because this pest rarely causes economic damage.			
Whiteflies			Pest is an increasing problem. Impacts market quality and yield.	Potash Soap	Label rates	Variable efficacy. Problems with phytotoxicity.
NEMATODES						
Nematodes - lesion, stem, dagger, needle, foliar, and root knot		Tolerant cultivars and certified nursery stock. Field soil sample analysis. Pre-plant hot water treatments for stock. Clean equipment to prevent transfer of nematodes. Crop rotation following fallow.	Cultural practices can be expensive and time consuming and can require pre-planning.	Methyl Bromide/ Chloropicrin Metam Sodium Oxamyl Chloropicrin	300-400 lbs Label rates Label rate Label rates	Preplant control. Very effective. Preplant applications. Variable, but satisfactory control with proper application techniques. Only registered for use on root knot and lesion nematodes on nonbearing nursery stock. May be phytotoxic to some cultivars. More research needed for efficacy.

PEST	NON-CHEMICAL TREATMENT			CHEMICAL TREATMENT		
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre?	Comments
Western Flower Thrips	Predator: Minute pirate bugs		Minute pirate bugs feed on thrips, but thrips feed on two-spotted spider and cylanen mites. Control is not usually necessary because this pest rarely causes economic damage.			
Whiteflies			Pest is an increasing problem. Impacts market quality and yield.	Potash Soap	Label rates	Variable efficacy. Problems with phytotoxicity.
NEMATODES						
Nematodes - lesion, stem, dagger, needle, foliar, and root knot		Tolerant cultivars and certified nursery stock. Field soil sample analysis. Pre-plant hot water treatments for stock. Clean equipment to prevent transfer of nematodes. Crop rotation following fallow.	Cultural practices can be expensive and time consuming and can require pre-planning.	Methyl Bromide/Chloropicrin	300-400 lbs	Preplant control. Very effective.
				Metam Sodium	Label rates	Preplant applications. Variable, but satisfactory control with proper application techniques.
				Oxamyl	Label rate	Only registered for use on root knot and lesion nematodes on nonbearing nursery stock. May be phytotoxic to some cultivars.
				Chloropicrin	Label rates	More research needed for efficacy.

PEST	NON-CHEMICAL TREATMENT		CHEMICAL TREATMENT ¹			
	Biological Control	Cultural Control	Comments	Active Ingredient	Rate/Acre ²	Comments
WEEDS						
Weeds, such as: Barley Barnyardgrass Bluegrass Burning nettle Common chickweed Common groundsel Filaree Little mallow		Opaque plastic mulches. Organic mulches: wood shavings, chopped straw, rice hulls. Solarization.	Need additional research.	Pre-plant: Methyl Bromide/ Chloropicrin	200-238 lbs 100-150 lbs	Applied to pre-irrigated soil. Must be tarped. Very effective.
				Metam Sodium DCPA Dacthal W-75	238-318 lbs 6-9 lb	Applied to pre-irrigated soil.
				Pre-plant: Post- emergence of Weed: Paraquat Gramoxone Extra	0.5 lb	
				Post-plant - post-emergence of Weed: DCPA Dacthal W-75	6-9 lbs	
				Napropamide Devrinol	2-4 lbs	May inhibit strawberry runners.
		Post-plant, post- emergence of weed Sethoxydim	0.38-0.47 lb		PHI: 7 days. Only 1 application per season allowed. Control varies with species.	

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1. Based on information from UCD IPM Program. This guide is not intended as a recommendation for use. See California-registered product labels for specific label rates and use directions.

2. Rates/200 gallons water/acre unless noted otherwise.

APPENDIX 2

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of ratings are given in the following table. Data is from the 1998 Pest Management Survey Database, which was developed jointly by DPR and the UC IPM Project. Department of Pesticide Regulation-- April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Re stat	Meet market standards	Yield red.	Svy se	Comments
ALFALFA LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		?	SOMETIMES	10	30	
ALFALFA LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2			G		N	ALWAYS	0	1	
ALFALFA LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	S COAST	2			G		N	ALWAYS	0	1	
ALFALFA LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	SAN JQ	2			G		N	ALWAYS	0	1	
ANGULAR LEAF SPOT (XANTHOMONAS FRAGARIAE)	PATHOGEN	AVOID OVERHEAD IRRIGATION	COASTAL	0		ADDITIONAL RESEARCH IS NEEDED				RARE	10	30	
ANGULAR LEAF SPOT (XANTHOMONAS FRAGARIAE)	PATHOGEN	CLEAN PLANTING STOCK	COASTAL	2		ADDITIONAL RESEARCH IS NEEDED				RARE	10	30	
ANGULAR LEAF SPOT (XANTHOMONAS FRAGARIAE)	PATHOGEN	VINCLOZOLIN	COASTAL	0			G	A	N	ALWAYS	0	4	
ANGULAR LEAF SPOT (XANTHOMONAS FRAGARIAE)	PATHOGEN	VINCLOZOLIN	COASTAL	0								30	
ANGULAR LEAF SPOT (XANTHOMONAS FRAGARIAE)	PATHOGEN	VINCLOZOLIN	S COAST	0			G	A	N	ALWAYS	0	4	
ANTHRACNOSE (COLLETOTRICHUM ACUTATUM)	PATHOGEN	BENOMYL	COASTAL	2			G		N	ALWAYS		4	
ANTHRACNOSE (COLLETOTRICHUM ACUTATUM)	PATHOGEN	BENOMYL	S COAST	2			G		N	ALWAYS		4	
ANTHRACNOSE (COLLETOTRICHUM ACUTATUM)	PATHOGEN	CLEAN PLANTING STOCK	COASTAL	2		ADDITIONAL RESEARCH IS NEEDED				SOMETIMES	20	30	
ANTHRACNOSE (COLLETOTRICHUM ACUTATUM)	PATHOGEN	DRIP OR FURROW IRRIGATION	COASTAL	0								30	
ANTHRACNOSE (COLLETOTRICHUM ACUTATUM)	PATHOGEN	IPRODIONE	COASTAL	2		RESTRICTED USE MATERIAL	G	A	N	ALWAYS	0	4	
ANTHRACNOSE (COLLETOTRICHUM ACUTATUM)	PATHOGEN	IPRODIONE	S COAST	2		RESTRICTED USE MATERIAL	G	A	N	ALWAYS	0	4	
APHIDS	INSECTS	AZADIRACTIN	COASTAL	4		ADDITIONAL RESEARCH IS NEEDED	G			UNKNOWN	?	1	
APHIDS	INSECTS	AZADIRACTIN	S COAST	4		ADDITIONAL RESEARCH IS NEEDED	G			UNKNOWN	?	1	
APHIDS	INSECTS	AZADIRACTIN	SAN JQ	4		ADDITIONAL RESEARCH IS NEEDED	G			UNKNOWN	?	1	
APHIDS	INSECTS	DIAZINON	COASTAL	2	IT PROVIDES A SHORT WORKER	ANOTHER SUBSTANCE OR TACTIC	G	A	?	FREQUENTLY	5	1	
APHIDS	INSECTS	DIAZINON	COASTAL	3	RE-ENTRY INTERVAL	ADDITIONAL RESEARCH IS NEEDED	G		?	FREQUENTLY	5	30	
APHIDS	INSECTS	DIAZINON	COASTAL	3	IT PROVIDES A SHORT WORKER	WEAK OR INEFFECTIVE ON PARTICULAR SPECIES	G		?	FREQUENTLY	5	30	
APHIDS	INSECTS	DIAZINON	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	FREQUENTLY	5	1	
APHIDS	INSECTS	DIAZINON	SAN JQ	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	FREQUENTLY	5	1	
APHIDS	INSECTS	MALATHION	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	FREQUENTLY	10	1	
APHIDS	INSECTS	MALATHION	COASTAL	2		SHORT OR NO RESIDUAL	G		Y	FREQUENTLY	10	1	
APHIDS	INSECTS	MALATHION	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	FREQUENTLY	10	1	
APHIDS	INSECTS	MALATHION	S COAST	2		SHORT OR NO RESIDUAL	G		Y	FREQUENTLY	10	1	
APHIDS	INSECTS	MALATHION	SAN JQ	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	FREQUENTLY	10	1	
APHIDS	INSECTS	MALATHION	SAN JQ	2		SHORT OR NO RESIDUAL	G		Y	FREQUENTLY	10	1	
APHIDS	INSECTS	NALED	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
APHIDS	INSECTS	NALED	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
APHIDS	INSECTS	NALED	SAN JQ	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
BARLEY	(WEEDS) PLANT	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							30	
BARNYARDGRASS	(WEEDS) PLANT	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							30	
BEET ARMYWORM	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		?	SOMETIMES	10	30	
BEET ARMYWORM	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	5	1	
BEET ARMYWORM	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	5	1	

[illegible]

Major pests and their methods of control in strawberries in California, from a survey

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of ratings are given in the following table. Data is from the 1996 Pest Management Survey Database, which was developed jointly by DPR and the UC IPM Project. Department of Pesticide Regulation-- April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Re list	Meet market standards	Yield red.	Svy ee	Comments
BLACK VINE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTING	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
BLACK VINE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTING	SAN JO	1		MORE EXPENSIVE				FREQUENTLY	?	1	
BLACK VINE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTING	SAN JO	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		MORE EXPENSIVE				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	4 OTHER		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	40	30	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		MORE EXPENSIVE				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JO	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JO	0		MORE EXPENSIVE				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JO	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
BLACK VINE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JO	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
BLUEGRASS	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3 NOT APPLICABLE								30	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	ANILAZINE	COASTAL	0								30	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	BENOMYL	COASTAL	2		POTENTIAL RESISTANCE PROBLEMS	G	A	N	ALWAYS	0	4	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	BENOMYL	S COAST	2		POTENTIAL RESISTANCE PROBLEMS	G	A	N	ALWAYS	0	4	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	CAPTAN	COASTAL	2	IT PROVIDES A SHORT WORKER 2 RE-ENTRY INTERVAL		G		N	ALWAYS	0	4	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	CAPTAN	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G		Y	SOMETIMES	10	30	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	CAPTAN	S COAST	2	IT PROVIDES A SHORT WORKER 2 RE-ENTRY INTERVAL		G		N	ALWAYS	0	4	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	REMOVAL & DESTRUCTION OF DEAD OR INFECTED PLANT MATERIAL.	COASTAL	2		ADDITIONAL RESEARCH IS NEEDED				SOMETIMES	20	30	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	USE PLASTIC MULCHES TO PREVENT BERRY-SOIL CONTACT.	COASTAL	2		ADDITIONAL RESEARCH IS NEEDED				SOMETIMES	20	30	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	VINCLOZOLIN	COASTAL	2			G	A	N	ALWAYS	0	4	
BOTRYTIS FRUIT ROT (GRAY MOLD)	PATHOGEN	VINCLOZOLIN	S COAST	2			G	A	N	ALWAYS	0	4	
BURNING NETTLE	(WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3 NOT APPLICABLE								30	
CABBAGE LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2			G		N	ALWAYS	1	1	
CABBAGE LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	S COAST	2			G		N	ALWAYS	1	1	
CABBAGE LOOPER	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	SAN JO	2			G		N	ALWAYS	1	1	
CABBAGE LOOPER	INSECTS	CHLORPYRIFOS	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	1	
CABBAGE LOOPER	INSECTS	CHLORPYRIFOS	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	1	
CABBAGE LOOPER	INSECTS	CHLORPYRIFOS	SAN JO	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	1	
CABBAGE LOOPER	INSECTS	ELIMINATE WEED HOSTS	COASTAL	0 OTHER		ADDITIONAL RESEARCH IS NEEDED				NEVER	10	30	
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUA AND A VIRUS.	COASTAL	0 OTHER		ADDITIONAL RESEARCH IS NEEDED				NEVER	10	30	
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUAE, CODIDOSOMA TRUNCATELLUM & NPV.	COASTAL	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	5	1	
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUAE, CODIDOSOMA TRUNCATELLUM & NPV.	COASTAL	1		LESS/VARIABLE EFFECTIVENESS				FREQUENTLY	5	1	

Major pests and their methods of control in strawberries in California, from a survey
This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of the ratings are given in the following table. Data is from the 1996 Pest Management Survey Database, which was developed jointly by DPR and the UC IPM Project. Department of Pesticide Regulation-- April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Re sist	Meet market standards	Yield red.	Svy se	Comments
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUAE, CODIOSOMA TRUNCATELLUM & NPV.	S COAST	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				ALWAYS	1	1	
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUAE, CODIOSOMA TRUNCATELLUM & NPV.	S COAST	1		LESS/VARIABLE EFFECTIVENESS				ALWAYS	1	1	
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUAE, CODIOSOMA TRUNCATELLUM & NPV.	SAN JQ	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				ALWAYS	1	1	
CABBAGE LOOPER	INSECTS	HYPOSOTER EXIGUAE, CODIOSOMA TRUNCATELLUM & NPV.	SAN JQ	1		LESS/VARIABLE EFFECTIVENESS				ALWAYS	1	1	
CITRUS THRIPS	INSECTS	FORMETANATE HYDROCHLORIDE	COASTAL	0									30
CITRUS THRIPS	INSECTS	FORMETANATE HYDROCHLORIDE	S COAST	4									1
COMMON CHICKWEED	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE								30
COMMON GROUNDSEL	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE								30
COMMON LAMBSQUARTERS	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE								30
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	BENOMYL	COASTAL	2			G		N	ALWAYS			4
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	BENOMYL	S COAST	2			G		N	ALWAYS			4
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	COPPER HYDROXIDE	COASTAL	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST	LESS/VARIABLE EFFECTIVENESS	G	A	N	ALWAYS	1	4	
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	COPPER HYDROXIDE	S COAST	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST	LESS/VARIABLE EFFECTIVENESS	G	A	N	ALWAYS	1	4	
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	DRIP IRRIGATION.	COASTAL	0									30
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	ENSURE PLANTING STOCK IS CLEAN.	COASTAL	4	OTHER								30
COMMON LEAF SPOT (RAMULARIA)	PATHOGEN	REMOVE INFECTED LEAVES WHEN PRACTICAL.	COASTAL	0									30
CORN EARWORM	INSECTS	CHLORPYRIFOS	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	5	1	
CORN EARWORM	INSECTS	CHLORPYRIFOS	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	5	1	
CORN EARWORM	INSECTS	CHLORPYRIFOS	SAN JQ	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	5	1	
CORN EARWORM	INSECTS	METHOMYL	COASTAL	1		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		?	ALWAYS	5	1	
CORN EARWORM	INSECTS	METHOMYL	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		?	FREQUENTLY	5	1	
CORN EARWORM	INSECTS	METHOMYL	SAN JQ	1		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		?	ALWAYS	5	1	
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	COASTAL	0	OTHER	ADDITIONAL RESEARCH IS NEEDED				RARE			30
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?		1
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	COASTAL	0		LOWER YIELD/LOWER GRADE MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN	?		1
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?		1
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	S COAST	0		LOWER YIELD/LOWER GRADE MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN	?		1
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?		1
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	SAN JQ	0		LOWER YIELD/LOWER GRADE MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN	?		1
CORN EARWORM	INSECTS	PLANT VERY EARLY MATURING SWEET CORN AROUND STRAWBERRY FIELDS.	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?		1
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	COASTAL	0	OTHER	ADDITIONAL RESEARCH IS NEEDED				RARE			30
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	COASTAL	0		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				UNKNOWN	?		1
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?		1
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	S COAST	0		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				UNKNOWN	?		1
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?		1

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This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of
by DPR and the UPR wide IPM Project. Department of Pesticide Regulation-- April 15, 1996

columns is given in the following table. Data is from the 1996 Pest Management Survey Database, wh

developed jointly

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Re list	Meet standards	Yield red.	Svy	Comments
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	S COAST	0		LOWER YIELD/LOWER GRADE EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				UNKNOWN	?	1	
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	SAN JQ	0						UNKNOWN	?	1	
CORN EARWORM	INSECTS	TRICHOGRAMMA PRETIOSUM & MINUTE PIRATE BUG.	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN	?	1	
COTTON MELON APHD	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	4 OTHER						FREQUENTLY	0	30	
COTTON MELON APHD	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	4								1	
COTTON MELON APHD	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	S COAST	4								1	
COTTON MELON APHD	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	SAN JQ	4								1	
COTTON MELON APHD	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0								30	
COTTON MELON APHD	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	4								1	
COTTON MELON APHD	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	S COAST	4								1	
COTTON MELON APHD	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	SAN JQ	4								1	
COTTON MELON APHD	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	2		MORE EXPENSIVE MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
CRIBRATE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	COASTAL	2						FREQUENTLY	?	1	
CRIBRATE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	S COAST	2		MORE EXPENSIVE MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
CRIBRATE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	S COAST	2		MORE EXPENSIVE MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
CRIBRATE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	SAN JQ	1		MORE EXPENSIVE MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
CRIBRATE WEEVIL	INSECTS	AVOID SECOND YEAR PLANTINGS	SAN JQ	1		MORE EXPENSIVE MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	?	1	
CRIBRATE WEEVIL	INSECTS	CHLOROPICRIN	COASTAL	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CRIBRATE WEEVIL	INSECTS	CHLOROPICRIN	S COAST	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CRIBRATE WEEVIL	INSECTS	CHLOROPICRIN	SAN JQ	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		MORE EXPENSIVE				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		SIGNIFICANT LABOR REQUIRED MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	4 OTHER						ALWAYS	40	30	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		MORE EXPENSIVE				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		MORE EXPENSIVE				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		MORE EXPENSIVE				UNKNOWN	?	1	
CRIBRATE WEEVIL	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	SAN JQ	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
CUTWORMS	INSECTS	AVOID SECOND YEAR PLANTINGS.	COASTAL	2		SIGNIFICANT LABOR REQUIRED MORE EXPENSIVE MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN	?	1	
CUTWORMS	INSECTS	AVOID SECOND YEAR PLANTINGS.	S COAST	2		MORE EXPENSIVE MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	5	1	
CUTWORMS	INSECTS	AVOID SECOND YEAR PLANTINGS.	S COAST	2		MORE EXPENSIVE MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	5	1	
CUTWORMS	INSECTS	AVOID SECOND YEAR PLANTINGS.	S COAST	2		MORE EXPENSIVE MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	1	1	
CUTWORMS	INSECTS	AVOID SECOND YEAR PLANTINGS.	SAN JQ	1		MORE EXPENSIVE				FREQUENTLY	1	1	

This table lists cherr
by DPR and the UC

Major pests and their methods of control in strawberries in California, from a survey
of non-chemical control methods for the major pests on strawberries in California. Explanations of
the IPM Project. Department of Pesticide Regulation-- April 15, 1998

in strawberries in California, from a survey
is given in the following table. Data is from the 1996 Pest Management Survey Database, which

developed jointly

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Re sist	Meet market standards	Yield red.	Svy ee	Comments
CUTWORMS	INSECTS	AVOID SECOND YEAR PLANTINGS.	SAN JO	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	1	1	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		?	FREQUENTLY	10	30	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	5	1	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	5	1	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	S COAST	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	5	1	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	5	1	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	SAN JO	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	5	1	
CUTWORMS	INSECTS	BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	SAN JO	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	5	1	
CUTWORMS	INSECTS	CARBARYL	COASTAL	2		WEAK OR INEFFECTIVE ON PARTICULAR SPECIES	G		N	FREQUENTLY	5	1	
CUTWORMS	INSECTS	CARBARYL	COASTAL	2	ONLY METHOD OR MATERIAL WHICH PROVIDES FOR A SHORT RE-PLANT INTERVAL	WEAK OR INEFFECTIVE ON PARTICULAR SPECIES	G		N	FREQUENTLY	1	1	
CUTWORMS	INSECTS	CARBARYL	S COAST	2			G			FREQUENTLY	10	30	
CUTWORMS	INSECTS	CARBARYL	SAN JO	2			G		N	ALWAYS	1	1	
CUTWORMS	INSECTS	CHLOROPICRIN	COASTAL	2			G		N	ALWAYS	1	1	
CUTWORMS	INSECTS	CHLOROPICRIN	S COAST	2			F		N	ALWAYS	0	1	
CUTWORMS	INSECTS	CHLOROPICRIN	SAN JO	2			F		N	ALWAYS	0	1	
CUTWORMS	INSECTS	CHLORPYRIFOS	COASTAL	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CUTWORMS	INSECTS	CHLORPYRIFOS	S COAST	2		WORKER SAFETY/HANDLING	G		N	ALWAYS	1	1	
CUTWORMS	INSECTS	CHLORPYRIFOS	SAN JO	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	1	1	
CUTWORMS	INSECTS	CHLORPYRIFOS	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	1	1	
CUTWORMS	INSECTS	DIAZINON	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	1	1	
CUTWORMS	INSECTS	DIAZINON	SAN JO	2			G	A	?	FREQUENTLY	5	1	
CUTWORMS	INSECTS	DIAZINON	COASTAL	2			G	A	?	FREQUENTLY	5	1	
CUTWORMS	INSECTS	METHYL BROMIDE	S COAST	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CUTWORMS	INSECTS	METHYL BROMIDE	SAN JO	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CUTWORMS	INSECTS	METHYL BROMIDE	COASTAL	2		WORKER SAFETY/HANDLING	F		N	ALWAYS	0	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	COASTAL	2		MORE EXPENSIVE	G		N	ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	S COAST	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	S COAST	2		MORE EXPENSIVE	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	SAN JO	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	SAN JO	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	SAN JO	2		MORE EXPENSIVE	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	SAN JO	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVERMECTIN	SAN JO	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE	G			ALWAYS	1	1	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	COASTAL	1 OTHER		LOWER YIELD/LOWER GRADE				RARE		30	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	COASTAL	2		MORE EXPENSIVE				FREQUENTLY	10	1	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	10	1	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	S COAST	2		MORE EXPENSIVE				FREQUENTLY	10	1	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	10	1	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	SAN JO	1		MORE EXPENSIVE				FREQUENTLY	10	1	
CYCLAMEN MITE	INSECTS	AVOID SECOND YEAR PLANTINGS IN PROBLEM AREAS.	SAN JO	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	10	1	
CYCLAMEN MITE	INSECTS	DICOFOL	COASTAL	1		POTENTIAL RESISTANCE PROBLEMS	G		Y	ALWAYS	20	1	

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of the ratings are given in the following table. Data is from the 1996 Pest Management Survey Database, which was developed jointly by DPR and the UC State IPM Project. Department of Pesticide Regulation-- April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3 METHOD OR MATERIAL IS NECESSARY TO MANAGE A PESTICIDE-RESISTANT PEST	Limitations	1st App	2nd App	Re sist	Meet market standards	Yield red.	Svy	Comments
CYCLAMEN MITE	INSECTS	DICOFOL	COASTAL	3		LESS/VARIABLE EFFECTIVENESS	G		Y	FREQUENTLY	10	30	
CYCLAMEN MITE	INSECTS	DICOFOL	S COAST	1		POTENTIAL RESISTANCE PROBLEMS	G		Y	ALWAYS	20	1	
CYCLAMEN MITE	INSECTS	DICOFOL	SAN JO	1		POTENTIAL RESISTANCE PROBLEMS	G		Y	ALWAYS	20	1	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	COASTAL	1	OTHER	LOWER YIELD/LOWER GRADE				RARE		30	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	COASTAL	2		LESS/VARIABLE EFFECTIVENESS				ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	COASTAL	2		MORE EXPENSIVE				ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	S COAST	2		LESS/VARIABLE EFFECTIVENESS				ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	S COAST	2		MORE EXPENSIVE				ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	SAN JO	1		LESS/VARIABLE EFFECTIVENESS				ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	DIP FREEZER TRAYS IN HOT WATER BETWEEN FIELDS.	SAN JO	1		MORE EXPENSIVE				ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	ENDOSULFAN	COASTAL	1		POTENTIAL GROUND WATER CONTAMINATION	G		N	ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	ENDOSULFAN	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		Y	SOMETIMES	10	30	
CYCLAMEN MITE	INSECTS	ENDOSULFAN	S COAST	1		POTENTIAL GROUND WATER CONTAMINATION	G		N	ALWAYS	10	1	
CYCLAMEN MITE	INSECTS	ENDOSULFAN	SAN JO	1		POTENTIAL GROUND WATER CONTAMINATION	G		N	ALWAYS	5	1	
CYCLAMEN MITE	INSECTS	PROPARGITE	SAN JO	1		POTENTIALLY PHYTOTOXIC	G		N	ALWAYS	5	1	
CYCLAMEN MITE	INSECTS	USE CLEAN STOCK.	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN		1	
CYCLAMEN MITE	INSECTS	USE CLEAN STOCK.	COASTAL	4	OTHER	LOWER YIELD/LOWER GRADE				RARE		30	
CYCLAMEN MITE	INSECTS	USE CLEAN STOCK.	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN		1	
CYCLAMEN MITE	INSECTS	USE CLEAN STOCK.	SAN JO	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				UNKNOWN		1	
CYCLAMEN MITE	INSECTS	USUALLY NOT EFFECTIVE: TYPHLODROMUS BELLINUS & RETICULATUS.	COASTAL	1	OTHER	LOWER YIELD/LOWER GRADE				RARE		30	
CYCLAMEN MITE	INSECTS	USUALLY NOT EFFECTIVE: TYPHLODROMUS BELLINUS & RETICULATUS.	COASTAL	4								1	
CYCLAMEN MITE	INSECTS	USUALLY NOT EFFECTIVE: TYPHLODROMUS BELLINUS & RETICULATUS.	S COAST	4								1	
CYCLAMEN MITE	INSECTS	USUALLY NOT EFFECTIVE: TYPHLODROMUS BELLINUS & RETICULATUS.	SAN JO	4								1	
EUROPEAN EARWIG	INSECTS	DESTROY RUBBISH NEAR STRAWBERRY FIELDS.	COASTAL	0								30	
EUROPEAN EARWIG	INSECTS	DESTROY RUBBISH NEAR STRAWBERRY FIELDS.	COASTAL	2		MORE EXPENSIVE				FREQUENTLY	1	1	
EUROPEAN EARWIG	INSECTS	DESTROY RUBBISH NEAR STRAWBERRY FIELDS.	S COAST	2		MORE EXPENSIVE				FREQUENTLY	1	1	
EUROPEAN EARWIG	INSECTS	DESTROY RUBBISH NEAR STRAWBERRY FIELDS.	SAN JO	1		MORE EXPENSIVE				FREQUENTLY	1	1	
FILAREE	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE							30	
FOLIAR NEMATODE (APHELENCHOIDES FRAGARIAE)	NEMATODES	CERTIFIED PLANTING STOCK.	COASTAL	4	OTHER							30	
FOLIAR NEMATODE (APHELENCHOIDES FRAGARIAE)	NEMATODES	HOT WATER TREATMENT OF PLANTING STOCK.	COASTAL	3	OTHER							30	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		MORE EXPENSIVE				UNKNOWN	?	1	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	

This table lists c
by DPR and the

Major pests and their methods of cr
and non-chemical control methods for the major pests on strawberries in California. Explanation:
 statewide IPM Project. Department of Pesticide Regulation-- April 15, 1998

1 strawberries in California, from a survey

columns is given in the following table. Data is from the 1998 Pest Management Survey Database, which was developed jointly

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 2	Limitations	1st App	2nd App	Re elist	Meet market standards	Yield red.	Buy on	Comments
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	COASTAL	4 OTHER		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	40	30	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				UNKNOWN	?	1	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		MORE EXPENSIVE				UNKNOWN	?	1	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		PROBLEMS WITH AVAILABILITY				UNKNOWN	?	1	
FULLER ROSE BEETLE	INSECTS	STICKY BARRIERS TO PREVENT MOVEMENT OF WEEVILS.	S COAST	0		SIGNIFICANT LABOR REQUIRED				UNKNOWN	?	1	
GARDEN SYMPHYLAN	INSECTS	CONTINUOUS FLOODING FOR THREE WEEKS IN THE SUMMER.	COASTAL	0								30	
GARDEN SYMPHYLAN	INSECTS	CONTINUOUS FLOODING FOR THREE WEEKS IN THE SUMMER.	COASTAL	4		ADDITIONAL RESEARCH IS NEEDED				UNKNOWN	?	1	
GARDEN SYMPHYLAN	INSECTS	CONTINUOUS FLOODING FOR THREE WEEKS IN THE SUMMER.	S COAST	4		ADDITIONAL RESEARCH IS NEEDED				UNKNOWN	?	1	
GARDEN SYMPHYLAN	INSECTS	CONTINUOUS FLOODING FOR THREE WEEKS IN THE SUMMER.	SAN JO	4		ADDITIONAL RESEARCH IS NEEDED				UNKNOWN	?	1	
GARDEN SYMPHYLAN	INSECTS	DISKING IN A CROP OF SORGHUM.	COASTAL	0								30	
GARDEN SYMPHYLAN	INSECTS	DISKING IN A CROP OF SORGHUM.	COASTAL	4		ADDITIONAL RESEARCH IS NEEDED				UNKNOWN	?	1	
GARDEN SYMPHYLAN	INSECTS	DISKING IN A CROP OF SORGHUM.	S COAST	4		ADDITIONAL RESEARCH IS NEEDED				UNKNOWN	?	1	
GARDEN SYMPHYLAN	INSECTS	DISKING IN A CROP OF SORGHUM.	SAN JO	4		ADDITIONAL RESEARCH IS NEEDED				UNKNOWN	?	1	
GARDEN TORTRIX	INSECTS	AVOID SECOND YEAR PLANTINGS.	COASTAL	1		MORE EXPENSIVE				FREQUENTLY	1	1	
GARDEN TORTRIX	INSECTS	AVOID SECOND YEAR PLANTINGS.	COASTAL	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	1	1	
GARDEN TORTRIX	INSECTS	AVOID SECOND YEAR PLANTINGS.	S COAST	1		MORE EXPENSIVE				FREQUENTLY	1	1	
GARDEN TORTRIX	INSECTS	AVOID SECOND YEAR PLANTINGS.	SAN JO	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	1	1	
GARDEN TORTRIX	INSECTS	AVOID SECOND YEAR PLANTINGS.	SAN JO	1		MORE EXPENSIVE				ALWAYS	0	1	
GARDEN TORTRIX	INSECTS	ELIMINATE WEED HOSTS	COASTAL	0 OTHER		ADDITIONAL RESEARCH IS NEEDED				NEVER	10	30	
GARDEN TORTRIX	INSECTS	HYPOSOTER EXGUA AND A VIRUS.	COASTAL	0 OTHER		ADDITIONAL RESEARCH IS NEEDED				NEVER	10	30	
GARDEN TORTRIX	INSECTS	REMOVE ACCUMULATED TRASH IN SPRING.	COASTAL	1		SIGNIFICANT LABOR REQUIRED				FREQUENTLY	5	1	
GARDEN TORTRIX	INSECTS	REMOVE ACCUMULATED TRASH IN SPRING.	S COAST	1		SIGNIFICANT LABOR REQUIRED				FREQUENTLY	5	1	
GARDEN TORTRIX	INSECTS	REMOVE ACCUMULATED TRASH IN SPRING.	SAN JO	1		SIGNIFICANT LABOR REQUIRED				ALWAYS	0	1	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	5	1	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	5	1	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	4 OTHER		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	0	30	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	S COAST	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	5	1	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	S COAST	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	5	1	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	SAN JO	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	1	1	
GREEN PEACH APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	SAN JO	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	1	1	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0		MORE EXPENSIVE				ALWAYS	?	1	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	?	1	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0								30	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	S COAST	0		MORE EXPENSIVE				ALWAYS	?	1	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	S COAST	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	?	1	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	SAN JO	0		MORE EXPENSIVE				ALWAYS	?	1	
GREEN PEACH APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	SAN JO	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	?	1	

Major pests and their methods of control in strawberries in California, from a survey
 This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of columns is given in the following table. Data is from the 1995 Pest Management Survey Database, which was developed jointly by DPR and the University of California IPM Project. Department of Pesticide Regulation-- April 15, 1998

	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Re-sit	Meet market standards	Yield red.	Key as	Comments
HAIRY NIGHTSHADE	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE								39
IRIS WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	COASTAL	0		MORE EXPENSIVE				ALWAYS	?	1	
IRIS WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	S COAST	1		MORE EXPENSIVE				ALWAYS	?	1	
IRIS WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	SAN JO	0		MORE EXPENSIVE				ALWAYS	?	1	
IRIS WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	COASTAL	0		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				UNKNOWN	?	1	
IRIS WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	S COAST	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				UNKNOWN	?	1	
IRIS WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	SAN JO	2		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				UNKNOWN	?	1	
LEATHER ROT (PHYTOPHTHORA)	PATHOGEN	AVOID FIELDS WITH WET SATURATED CONDITIONS. NO OVERHEAD IRRIGATION.	COASTAL	1		ADDITIONAL RESEARCH IS NEEDED				RARE		5	39
LEATHER ROT (PHYTOPHTHORA)	PATHOGEN	METALAXYL	COASTAL	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST		G		N	ALWAYS			4
LEATHER ROT (PHYTOPHTHORA)	PATHOGEN	METALAXYL	S COAST	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST		G		N	ALWAYS			4
LEATHER ROT (PHYTOPHTHORA)	PATHOGEN	METHYL BROMIDE	COASTAL	4		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	4	
LEATHER ROT (PHYTOPHTHORA)	PATHOGEN	METHYL BROMIDE	S COAST	4		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	4	
LEATHER ROT (PHYTOPHTHORA)	PATHOGEN	PLASTIC MULCHES.	COASTAL	1		ADDITIONAL RESEARCH IS NEEDED				RARE		5	39
LEATHER ROT (PHYTOPHTHORA)	PATHOGEN	REMOVE DISEASED FRUIT.	COASTAL	1		ADDITIONAL RESEARCH IS NEEDED				RARE		5	39
LEATHER ROT (PHYTOPHTHORA)	PATHOGEN	SELECT FIELDS ISOLATED FROM CONVENTIONAL GROWING AREAS.	COASTAL	0		ADDITIONAL RESEARCH IS NEEDED				RARE		5	39
LITTLE MALLOW	PLANT (WEEDS)	OPAQUE PLASTIC MULCHES	COASTAL	3	NOT APPLICABLE								39
LYGUS BUG	INSECTS	CHLOROPICRIN	COASTAL	0									39
LYGUS BUG	INSECTS	CONTROL WEEDS WITHIN AND AROUND THE FIELD.	COASTAL	2		MORE EXPENSIVE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	CONTROL WEEDS WITHIN AND AROUND THE FIELD.	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	CONTROL WEEDS WITHIN AND AROUND THE FIELD.	S COAST	1		MORE EXPENSIVE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	CONTROL WEEDS WITHIN AND AROUND THE FIELD.	S COAST	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	CONTROL WEEDS WITHIN AND AROUND THE FIELD.	SAN JO	0		MORE EXPENSIVE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	CONTROL WEEDS WITHIN AND AROUND THE FIELD.	SAN JO	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	DIAZINON	COASTAL	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	DIAZINON	COASTAL	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G	A	?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	DIAZINON	COASTAL	1		WEAK OR INEFFECTIVE ON PARTICULAR SPECIES	G	A	?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	DIAZINON	SAN JO	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	DIAZINON	SAN JO	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G	A	?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	DIAZINON	SAN JO	1		WEAK OR INEFFECTIVE ON PARTICULAR SPECIES	G	A	?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	MALATHION	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		Y	SOMETIMES	20	39	
LYGUS BUG	INSECTS	MALATHION	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	SOMETIMES	20	1	
LYGUS BUG	INSECTS	MALATHION	COASTAL	2		SHORT OR NO RESIDUAL	G		Y	SOMETIMES	20	1	
LYGUS BUG	INSECTS	MALATHION	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	SOMETIMES	20	1	
LYGUS BUG	INSECTS	MALATHION	S COAST	2		SHORT OR NO RESIDUAL	G		Y	SOMETIMES	20	1	
LYGUS BUG	INSECTS	MALATHION	SAN JO	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	SOMETIMES	20	1	

Major pests and their methods of control in strawberries in California, from a survey

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations
by DPR and the statewide IPM Project. Department of Pesticide Regulation-- April 15, 1998

columns is given in the following table. Data is from the 1998 Pest Management Survey Database, w

developed jointly

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Ra sist Y	Most market standards	Yield red.	Srv as	Comments
LYGUS BUG	INSECTS	MALATHION	SAN JO	2		SHORT OR NO RESIDUAL	G			SOMETIMES	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	COASTAL	1		LESS/VARIABLE EFFECTIVENESS				RARE	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	COASTAL	1		LOW THRESHOLD FOR DAMAGE				RARE	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	COASTAL	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				RARE	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	S COAST	1		LESS/VARIABLE EFFECTIVENESS				FREQUENTLY	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	S COAST	1		LOW THRESHOLD FOR DAMAGE				FREQUENTLY	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	S COAST	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	SAN JO	1		LESS/VARIABLE EFFECTIVENESS				FREQUENTLY	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	SAN JO	1		LOW THRESHOLD FOR DAMAGE				FREQUENTLY	20	1	
LYGUS BUG	INSECTS	MANY PREDATORS ON THE NYMPHAL STAGE.	SAN JO	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	20	1	
LYGUS BUG	INSECTS	METHOMYL	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	SOMETIMES	10	1	
LYGUS BUG	INSECTS	METHOMYL	COASTAL	3	METHOD OR MATERIAL IS NECESSARY TO MANAGE A PESTICIDE-RESISTANT PEST	REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	SOMETIMES	10	30	
LYGUS BUG	INSECTS	METHOMYL	SAN JO	1		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
LYGUS BUG	INSECTS	METHYL BROMIDE	COASTAL	0								30	
LYGUS BUG	INSECTS	MEVINPHOS	COASTAL	0								30	
LYGUS BUG	INSECTS	MOW OR DISC UNDER COVER CROPS BEFORE THEY FLOWER.	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	MOW OR DISC UNDER COVER CROPS BEFORE THEY FLOWER.	COASTAL	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	MOW OR DISC UNDER COVER CROPS BEFORE THEY FLOWER.	S COAST	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	MOW OR DISC UNDER COVER CROPS BEFORE THEY FLOWER.	S COAST	0		TEMPERATURE AND/OR SEASONAL DEPENDENCE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	MOW OR DISC UNDER COVER CROPS BEFORE THEY FLOWER.	SAN JO	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	MOW OR DISC UNDER COVER CROPS BEFORE THEY FLOWER.	SAN JO	0		TEMPERATURE AND/OR SEASONAL DEPENDENCE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	NALED	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		?	SOMETIMES	20	1	
LYGUS BUG	INSECTS	NALED	COASTAL	2		WEAK OR INEFFECTIVE ON PARTICULAR SPECIES	G		Y	SOMETIMES	10	30	
LYGUS BUG	INSECTS	NALED	SAN JO	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		?	FREQUENTLY	10	1	
LYGUS BUG	INSECTS	PETROLEUM DISTILLATES, AROMATIC	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		Y	SOMETIMES	10	30	
LYGUS BUG	INSECTS	PYRETHRINS	COASTAL	0		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	COASTAL	0		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	COASTAL	0		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	COASTAL	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	S COAST	0		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	S COAST	0		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	S COAST	0		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	S COAST	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	SAN JO	0		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	SAN JO	0		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	SAN JO	0		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	PYRETHRINS	SAN JO	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	COASTAL	1		LESS/VARIABLE EFFECTIVENESS				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	COASTAL	1		MORE EXPENSIVE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	COASTAL	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	S COAST	0		LESS/VARIABLE EFFECTIVENESS				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	S COAST	0		MORE EXPENSIVE				SOMETIMES	20	1	

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of the ratings are given in the following table. Data is from the 1996 Pest Management Survey Database, which was developed jointly by DPR and the UC S IPM Project. Department of Pesticide Regulation—April 15, 1996

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Re sist	Meet market standards	Yield red.	Svy es	Comments
LYGUS BUG	INSECTS	SUCTION DEVICES.	S COAST	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	SAN JQ	0		LESS/VARIABLE EFFECTIVENESS				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	SAN JQ	0		MORE EXPENSIVE				SOMETIMES	20	1	
LYGUS BUG	INSECTS	SUCTION DEVICES.	SAN JQ	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	20	1	
MITES	INSECTS	FENBUTATIN-OXIDE	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		Y	SOMETIMES	10	30	
MITES	INSECTS	PROPARGITE	COASTAL	4		POTENTIALLY PHYTOTOXIC	G		N	ALWAYS	10	30	
MITES	INSECTS	SULFUR	COASTAL	2			G		Y	SOMETIMES	10	30	
ORANGE TORTRIX	INSECTS	CRYOLITE	COASTAL	0									
ORANGE TORTRIX	INSECTS	CRYOLITE	COASTAL										
ORANGE TORTRIX	INSECTS	CRYOLITE	S COAST			LESS/VARIABLE EFFECTIVENESS	G		N	UNKNOWN	5	1	
ORANGE TORTRIX	INSECTS	CRYOLITE	S COAST			LESS/VARIABLE EFFECTIVENESS	G		N	UNKNOWN	1	1	
ORANGE TORTRIX	INSECTS	ELIMINATE WEED HOSTS	COASTAL	0	OTHER	ADDITIONAL RESEARCH IS NEEDED				NEVER	10	30	
ORANGE TORTRIX	INSECTS	HYPOSPOTER EXQUA AND A VIRUS.	COASTAL	0	OTHER	ADDITIONAL RESEARCH IS NEEDED				NEVER	10	30	
PHYTOPHTHORA CROWN ROT	PATHOGEN	CHLOROPICRIN	COASTAL	4			F		N	ALWAYS	0	4	
PHYTOPHTHORA CROWN ROT	PATHOGEN	CHLOROPICRIN	S COAST	4			F		N	ALWAYS	0	4	
PHYTOPHTHORA CROWN ROT	PATHOGEN	METALAXYL	COASTAL	1		ADDITIONAL RESEARCH IS NEEDED	C		?	UNKNOWN	?	30	
PHYTOPHTHORA CROWN ROT	PATHOGEN	METALAXYL	COASTAL	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST	BEST IF APPLIED THROUGH DRIP IRRIGATION	G		N	ALWAYS	0	4	
PHYTOPHTHORA CROWN ROT	PATHOGEN	METALAXYL	S COAST	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST	BEST IF APPLIED THROUGH DRIP IRRIGATION	G		N	ALWAYS	0	4	
PHYTOPHTHORA CROWN ROT	PATHOGEN	USE CLEAN PLANT STOCK.	COASTAL	4		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	40	30	
PHYTOPHTHORA CROWN ROT	PATHOGEN	USE CULTIVARS SUITABLE FOR LOCAL CONDITIONS.	COASTAL	0									
PHYTOPHTHORA CROWN ROT	PATHOGEN	USE RAISED BEDS & DRIP IRRIGATION.	COASTAL	0									
PHYTOPHTHORA CROWN ROT	PATHOGEN	GOOD DRAINAGE.	COASTAL	4						ALWAYS	40	30	
POTATO APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	4	OTHER	MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	0	30	
POTATO APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	4									
POTATO APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	S COAST	4									
POTATO APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	SAN JQ	4									
POTATO APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0									
POTATO APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	4									
POTATO APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	S COAST	4									
POTATO APHID	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	SAN JQ	4									
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	AMPELOMYCES QUISQUALIS	COASTAL	1						SOMETIMES	10	4	
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	AMPELOMYCES QUISQUALIS	COASTAL	2			G	A	N	ALWAYS	0	4	NEW PRODUCT
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	AMPELOMYCES QUISQUALIS	S COAST	2			G	A	N	ALWAYS	0	4	NEW PRODUCT
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	MYCLOBUTANIL	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G	A	N	ALWAYS	0	4	
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	MYCLOBUTANIL	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G	A	N	ALWAYS	0	4	
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	SULFUR	COASTAL	2	PRODUCT OR METHOD IS CRITICAL TO MAINTAIN A BIOLOGICALLY INTENSIVE IPM PROGRAM	REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	ALWAYS	1	4	
POWDERY MILDEW (SPHAEROTHECA MACULARIS)	PATHOGEN	SULFUR	S COAST	2	PRODUCT OR METHOD IS CRITICAL TO MAINTAIN A BIOLOGICALLY INTENSIVE IPM PROGRAM	REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	ALWAYS	1	4	
ED STEELE (PHYTOPHTHORA RAGARIAE)	PATHOGEN	METHYL BROMIDE	COASTAL	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST		F		N	ALWAYS		4	
ED STEELE (PHYTOPHTHORA RAGARIAE)	PATHOGEN	METHYL BROMIDE	S COAST	3	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST		F		N	ALWAYS		4	
HIZOPUS FRUIT ROT (LEAK)	PATHOGEN	FIELD SANITATION.	COASTAL	2	ONLY KNOWN CONTROL WHICH IS EFFICACIOUS AGAINST PEST	TEMPERATURE AND/OR SEASONAL DEPENDENCE				FREQUENTLY	20	30	

[illegible]

Major pests and their methods of control on strawberries in California, from a survey													
This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations by DPR and the statewide IPM Project. Department of Pesticide Regulation—April 15, 1995		columns is given in the following table. Data is from the 1995 Pest Management Survey Database, which was developed jointly by DPR and the University of California, Davis											
Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Rate	Meet market standards	Yield red.	Srv on	Comments
SNAILS	INSECTS	COPPER BARRIERS	SAN JO	0	ONLY PRODUCT REGISTERED FOR THIS HOST-PEST	REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS				SOMETIMES	10	1	
SNAILS	INSECTS	METALDEHYDE	COASTAL	3	COMBINATION ONLY REGISTERED PRODUCT WHICH ENABLES THE COMMODITY TO MEET MARKET (INCLUDING EXPORT)		G		N	FREQUENTLY	1	1	
SNAILS	INSECTS	METALDEHYDE	COASTAL	3	REQUIREMENTS	REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	FREQUENTLY	1	1	
SNAILS	INSECTS	METALDEHYDE	COASTAL	4	ONLY PRODUCT REGISTERED FOR THIS HOST-PEST		G		N	FREQUENTLY	10	30	
SNAILS	INSECTS	METALDEHYDE	S COAST	3	COMBINATION ONLY REGISTERED PRODUCT WHICH ENABLES THE COMMODITY TO MEET MARKET (INCLUDING EXPORT)		G		N	FREQUENTLY	1	1	
SNAILS	INSECTS	METALDEHYDE	S COAST	3	REQUIREMENTS		G		N	FREQUENTLY	1	1	
SNAILS	INSECTS	METALDEHYDE	SAN JO	3	COMBINATION ONLY REGISTERED PRODUCT WHICH ENABLES THE COMMODITY TO MEET MARKET (INCLUDING EXPORT)		G		N	FREQUENTLY	1	1	
SNAILS	INSECTS	METALDEHYDE	SAN JO	3	REQUIREMENTS		G		N	FREQUENTLY	1	1	
STRAWBERRY APHID	INSECTS	DIAZINON	COASTAL	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	FREQUENTLY	5	1	
STRAWBERRY APHID	INSECTS	DIAZINON	S COAST	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	FREQUENTLY	5	1	
STRAWBERRY APHID	INSECTS	DIAZINON	SAN JO	2		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC	G	A	?	FREQUENTLY	5	1	
STRAWBERRY APHID	INSECTS	MALATHION	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	MALATHION	COASTAL	2		SHORT OR NO RESIDUAL	G		Y	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	MALATHION	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	MALATHION	S COAST	2		SHORT OR NO RESIDUAL	G		Y	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	MALATHION	SAN JO	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		Y	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	MALATHION	SAN JO	2		SHORT OR NO RESIDUAL	G		Y	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	NALED	COASTAL	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	NALED	S COAST	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	NALED	SAN JO	2		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	COASTAL	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	COASTAL	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	COASTAL	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	S COAST	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	S COAST	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	S COAST	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	S COAST	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	SAN JO	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	SAN JO	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	SAN JO	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	POTASH SOAP	SAN JO	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
STRAWBERRY APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	5	1	
STRAWBERRY APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	5	1	
STRAWBERRY APHID	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	COASTAL	4	OTHER	MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				FREQUENTLY	0	30	

Major pests and their methods of control in strawberries in California, from a survey

This table lists chemical and non-chemical control methods for the major pests on strawberries in California. Explanations of why a method is given in the following table. Data is from the 1998 Pest Management Survey Database, which was developed jointly by DPR and the UC IPM Project. Department of Pesticide Regulation-- April 15, 1998

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Re stat	Most market standards	Yield red.	Srv us	Comments
STRAWBERRY APHD	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	S COAST	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	5	1	
STRAWBERRY APHD	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	S COAST	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	5	1	
STRAWBERRY APHD	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	SAN JQ	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				SOMETIMES	1	1	
STRAWBERRY APHD	INSECTS	PREDATORS MORE IMPORTANT THAN PARASITES.	SAN JQ	1		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				SOMETIMES	1	1	
STRAWBERRY APHD	INSECTS	PYRETHRINS	COASTAL	1		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
STRAWBERRY APHD	INSECTS	PYRETHRINS	COASTAL	1		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
STRAWBERRY APHD	INSECTS	PYRETHRINS	COASTAL	1		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
STRAWBERRY APHD	INSECTS	PYRETHRINS	COASTAL	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
STRAWBERRY APHD	INSECTS	PYRETHRINS	S COAST	1		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
STRAWBERRY APHD	INSECTS	PYRETHRINS	S COAST	1		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
STRAWBERRY APHD	INSECTS	PYRETHRINS	S COAST	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
STRAWBERRY APHD	INSECTS	PYRETHRINS	SAN JQ	1		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
STRAWBERRY APHD	INSECTS	PYRETHRINS	SAN JQ	1		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
STRAWBERRY APHD	INSECTS	PYRETHRINS	SAN JQ	1		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
STRAWBERRY APHD	INSECTS	PYRETHRINS	SAN JQ	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
STRAWBERRY APHD	INSECTS	PYRETHRINS	SAN JQ	1		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
STRAWBERRY APHD	INSECTS	ROTENONE	SAN JQ	1						SOMETIMES	20	1	
STRAWBERRY APHD	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0		MORE EXPENSIVE				ALWAYS	?	1	
STRAWBERRY APHD	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	?	1	
STRAWBERRY APHD	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	COASTAL	0								39	
STRAWBERRY APHD	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	S COAST	0		MORE EXPENSIVE				ALWAYS	?	1	
STRAWBERRY APHD	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	S COAST	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	?	1	
STRAWBERRY APHD	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	SAN JQ	0		MORE EXPENSIVE				ALWAYS	?	1	
STRAWBERRY APHD	INSECTS	ROW COVERS (PLASTIC TUNNELS & REMAY-TYPE ENCLOSURES).	SAN JQ	0		MUST BE USED IN CONJUNCTION WITH ANOTHER SUBSTANCE OR TACTIC				ALWAYS	?	1	
STRAWBERRY WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	COASTAL	0							0	39	
STRAWBERRY WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	COASTAL	1		MORE EXPENSIVE				FREQUENTLY	?	1	
STRAWBERRY WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	S COAST	1		MORE EXPENSIVE				FREQUENTLY	?	1	
STRAWBERRY WHITEFLY	INSECTS	FOR SUMMER PLANTED, TOPPING IN SPRING CAN REDUCE OW POPULATIONS.	SAN JQ	0		MORE EXPENSIVE				ALWAYS	?	1	
STRAWBERRY WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	COASTAL	0							0	39	
STRAWBERRY WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	COASTAL	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	?	1	
STRAWBERRY WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	S COAST	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	?	1	
STRAWBERRY WHITEFLY	INSECTS	MANY PARASITES & PREDATORS.	SAN JQ	1		EFFECTIVENESS DEPENDS ON CHEMICAL SPRAY PROGRAM				FREQUENTLY	?	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	COASTAL	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	COASTAL	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	COASTAL	2		POTENTIALLY PHYTOXIC	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	S COAST	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	S COAST	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	S COAST	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	S COAST	2		POTENTIALLY PHYTOXIC	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	SAN JQ	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	SAN JQ	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	SAN JQ	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	

This table lists chem-
by DPR and the UC

Major pests and their methods of control in strawberries in California, from a survey
non-chemical control methods for the major pests on strawberries in California. Explanations of
the IPM Project. Department of Pesticide Regulation-- April 15, 1996

strawberries in California, from a survey
is given in the following table. Data is from the 1996 Pest Management Survey Database, which
adopted jointly

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st App	2nd App	Re-est	Plant material standards	Yield red.	Survival	Comments
STRAWBERRY WHITEFLY	INSECTS	POTASH SOAP	SAN JO	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	COASTAL	2		MORE EXPENSIVE	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	COASTAL	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	COASTAL	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	S COAST	2		MORE EXPENSIVE	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	S COAST	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	S COAST	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	SAN JO	2		MORE EXPENSIVE	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	SAN JO	2		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	AVERMECTIN	SAN JO	2		TEMPERATURE AND/OR SEASONAL DEPENDENCE	G			ALWAYS	1	1	
TWOSPOTTED SPIDER MITE	INSECTS	FENBUTATIN-OXIDE	COASTAL	2		POTENTIAL RESISTANCE PROBLEMS	G		?	ALWAYS	5	1	
TWOSPOTTED SPIDER MITE	INSECTS	FENBUTATIN-OXIDE	S COAST	2		POTENTIAL RESISTANCE PROBLEMS	G		?	ALWAYS	5	1	
TWOSPOTTED SPIDER MITE	INSECTS	FENBUTATIN-OXIDE	SAN JO	2		POTENTIAL RESISTANCE PROBLEMS	G		?	ALWAYS	5	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	COASTAL	0		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	COASTAL	0		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	COASTAL	0		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	S COAST	0		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	S COAST	0		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	S COAST	0		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	S COAST	0		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	SAN JO	0		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	SAN JO	0		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	PETROLEUM OIL, UNCLASSIFIED	SAN JO	0		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	COASTAL	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	COASTAL	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	COASTAL	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	COASTAL	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	COASTAL	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	S COAST	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	S COAST	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	S COAST	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	S COAST	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	S COAST	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	SAN JO	2		LESS/VARIABLE EFFECTIVENESS	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	SAN JO	2		LOWER YIELD/LOWER GRADE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	SAN JO	2		MORE EXPENSIVE	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	POTASH SOAP	SAN JO	2		POTENTIALLY PHYTOTOXIC	G		N	FREQUENTLY	10	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	COASTAL	0		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	COASTAL	0		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	COASTAL	0		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	COASTAL	0		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	COASTAL	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	S COAST	0		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	S COAST	0		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	S COAST	0		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	S COAST	0		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	S COAST	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	SAN JO	0		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	SAN JO	0		LESS/VARIABLE EFFECTIVENESS	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	SAN JO	0		LOWER YIELD/LOWER GRADE	G		N	SOMETIMES	20	1	
TWOSPOTTED SPIDER MITE	INSECTS	ROTENONE	SAN JO	0		MORE EXPENSIVE	G		N	SOMETIMES	20	1	
VERTICILLIUM WILT	PATHOGEN	CHLOROPICRIN	SAN JO	0		REQUIRES MULTIPLE TREATMENTS OR APPLICATIONS	G		N	SOMETIMES	20	1	
VERTICILLIUM WILT	PATHOGEN	CHLOROPICRIN	COASTAL	4			F		N	ALWAYS	0	4	
VERTICILLIUM WILT	PATHOGEN	METHYL BROMIDE	COASTAL	4		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	F		N	ALWAYS	0	4	
VERTICILLIUM WILT	PATHOGEN	METHYL BROMIDE	S COAST	4		KILLS BENEFICIAL AND/OR NONTARGET ORGANISMS	G		N	ALWAYS	0	4	

Agency participation in

Plant	Plant Type	At or Control Method	Region	Rank	expansion for	Limitations	1st App	2nd App	3rd App	4th App	5th App	6th App	7th App	8th App	9th App	10th App	11th App	12th App	13th App	14th App	15th App	16th App	17th App	18th App	19th App	20th App	21st App	22nd App	23rd App	24th App	25th App	26th App	27th App	28th App	29th App	30th App	31st App	32nd App	33rd App	34th App	35th App	36th App	37th App	38th App	39th App	40th App	41st App	42nd App	43rd App	44th App	45th App	46th App	47th App	48th App	49th App	50th App	51st App	52nd App	53rd App	54th App	55th App	56th App	57th App	58th App	59th App	60th App	61st App	62nd App	63rd App	64th App	65th App	66th App	67th App	68th App	69th App	70th App	71st App	72nd App	73rd App	74th App	75th App	76th App	77th App	78th App	79th App	80th App	81st App	82nd App	83rd App	84th App	85th App	86th App	87th App	88th App	89th App	90th App	91st App	92nd App	93rd App	94th App	95th App	96th App	97th App	98th App	99th App	100th App	101st App	102nd App	103rd App	104th App	105th App	106th App	107th App	108th App	109th App	110th App	111th App	112th App	113th App	114th App	115th App	116th App	117th App	118th App	119th App	120th App	121st App	122nd App	123rd App	124th App	125th App	126th App	127th App	128th App	129th App	130th App	131st App	132nd App	133rd App	134th App	135th App	136th App	137th App	138th App	139th App	140th App	141st App	142nd App	143rd App	144th App	145th App	146th App	147th App	148th App	149th App	150th App	151st App	152nd App	153rd App	154th App	155th App	156th App	157th App	158th App	159th App	160th App	161st App	162nd App	163rd App	164th App	165th App	166th App	167th App	168th App	169th App	170th App	171st App	172nd App	173rd App	174th App	175th App	176th App	177th App	178th App	179th App	180th App	181st App	182nd App	183rd App	184th App	185th App	186th App	187th App	188th App	189th App	190th App	191st App	192nd App	193rd App	194th App	195th App	196th App	197th App	198th App	199th App	200th App	201st App	202nd App	203rd App	204th App	205th App	206th App	207th App	208th App	209th App	210th App	211st App	212nd App	213rd App	214th App	215th App	216th App	217th App	218th App	219th App	220th App	221st App	222nd App	223rd App	224th App	225th App	226th App	227th App	228th App	229th App	230th App	231st App	232nd App	233rd App	234th App	235th App	236th App	237th App	238th App	239th App	240th App	241st App	242nd App	243rd App	244th App	245th App	246th App	247th App	248th App	249th App	250th App	251st App	252nd App	253rd App	254th App	255th App	256th App	257th App	258th App	259th App	260th App	261st App	262nd App	263rd App	264th App	265th App	266th App	267th App	268th App	269th App	270th App	271st App	272nd App	273rd App	274th App	275th App	276th App	277th App	278th App	279th App	280th App	281st App	282nd App	283rd App	284th App	285th App	286th App	287th App	288th App	289th App	290th App	291st App	292nd App	293rd App	294th App	295th App	296th App	297th App	298th App	299th App	300th App	301st App	302nd App	303rd App	304th App	305th App	306th App	307th App	308th App	309th App	310th App	311st App	312nd App	313rd App	314th App	315th App	316th App	317th App	318th App	319th App	320th App	321st App	322nd App	323rd App	324th App	325th App	326th App	327th App	328th App	329th App	330th App	331st App	332nd App	333rd App	334th App	335th App	336th App	337th App	338th App	339th App	340th App	341st App	342nd App	343rd App	344th App	345th App	346th App	347th App	348th App	349th App	350th App	351st App	352nd App	353rd App	354th App	355th App	356th App	357th App	358th App	359th App	360th App	361st App	362nd App	363rd App	364th App	365th App	366th App	367th App	368th App	369th App	370th App	371st App	372nd App	373rd App	374th App	375th App	376th App	377th App	378th App	379th App	380th App	381st App	382nd App	383rd App	384th App	385th App	386th App	387th App	388th App	389th App	390th App	391st App	392nd App	393rd App	394th App	395th App	396th App	397th App	398th App	399th App	400th App	401st App	402nd App	403rd App	404th App	405th App	406th App	407th App	408th App	409th App	410th App	411st App	412nd App	413rd App	414th App	415th App	416th App	417th App	418th App	419th App	420th App	421st App	422nd App	423rd App	424th App	425th App	426th App	427th App	428th App	429th App	430th App	431st App	432nd App	433rd App	434th App	435th App	436th App	437th App	438th App	439th App	440th App	441st App	442nd App	443rd App	444th App	445th App	446th App	447th App	448th App	449th App	450th App	451st App	452nd App	453rd App	454th App	455th App	456th App	457th App	458th App	459th App	460th App	461st App	462nd App	463rd App	464th App	465th App	466th App	467th App	468th App	469th App	470th App	471st App	472nd App	473rd App	474th App	475th App	476th App	477th App	478th App	479th App	480th App	481st App	482nd App	483rd App	484th App	485th App	486th App	487th App	488th App	489th App	490th App	491st App	492nd App	493rd App	494th App	495th App	496th App	497th App	498th App	499th App	500th App	501st App	502nd App	503rd App	504th App	505th App	506th App	507th App	508th App	509th App	510th App	511st App	512nd App	513rd App	514th App	515th App	516th App	517th App	518th App	519th App	520th App	521st App	522nd App	523rd App	524th App	525th App	526th App	527th App	528th App	529th App	530th App	531st App	532nd App	533rd App	534th App	535th App	536th App	537th App	538th App	539th App	540th App	541st App	542nd App	543rd App	544th App	545th App	546th App	547th App	548th App	549th App	550th App	551st App	552nd App	553rd App	554th App	555th App	556th App	557th App	558th App	559th App	560th App	561st App	562nd App	563rd App	564th App	565th App	566th App	567th App	568th App	569th App	570th App	571st App	572nd App	573rd App	574th App	575th App	576th App	577th App	578th App	579th App	580th App	581st App	582nd App	583rd App	584th App	585th App	586th App	587th App	588th App	589th App	590th App	591st App	592nd App	593rd App	594th App	595th App	596th App	597th App	598th App	599th App	600th App	601st App	602nd App	603rd App	604th App	605th App	606th App	607th App	608th App	609th App	610th App	611st App	612nd App	613rd App	614th App	615th App	616th App	617th App	618th App	619th App	620th App	621st App	622nd App	623rd App	624th App	625th App	626th App	627th App	628th App	629th App	630th App	631st App	632nd App	633rd App	634th App	635th App	636th App	637th App	638th App	639th App	640th App	641st App	642nd App	643rd App	644th App	645th App	646th App	647th App	648th App	649th App	650th App	651st App	652nd App	653rd App	654th App	655th App	656th App	657th App	658th App	659th App	660th App	661st App	662nd App	663rd App	664th App	665th App	666th App	667th App	668th App	669th App	670th App	671st App	672nd App	673rd App	674th App	675th App	676th App	677th App	678th App	679th App	680th App	681st App	682nd App	683rd App	684th App	685th App	686th App	687th App	688th App	689th App	690th App	691st App	692nd App	693rd App	694th App	695th App	696th App	697th App	698th App	699th App	700th App	701st App	702nd App	703rd App	704th App	705th App	706th App	707th App	708th App	709th App	710th App	711st App	712nd App	713rd App	714th App	715th App	716th App	717th App	718th App	719th App	720th App	721st App	722nd App	723rd App	724th App	725th App	726th App	727th App	728th App	729th App	730th App	731st App	732nd App	733rd App	734th App	735th App	736th App	737th App	738th App	739th App	740th App	741st App	742nd App	743rd App	744th App	745th App	746th App	747th App	748th App	749th App	750th App	751st App	752nd App	753rd App	754th App	755th App	756th App	757th App	758th App	759th App	760th App	761st App	762nd App	763rd App	764th App	765th App	766th App	767th App	768th App	769th App	770th App	771st App	772nd App	773rd App	774th App	775th App	776th App	777th App	778th App	779th App	780th App	781st App	782nd App	783rd App	784th App	785th App	786th App	787th App	788th App	789th App	790th App	791st App	792nd App	793rd App	794th App	795th App	796th App	797th App	798th App	799th App	800th App	801st App	802nd App	803rd App	804th App	805th App	806th App	807th App	808th App	809th App	810th App	811st App	812nd App	813rd App	814th App	815th App	816th App	817th App	818th App	819th App	820th App	821st App	822nd App	823rd App	824th App	825th App	826th App	827th App	828th App	829th App	830th App	831st App	832nd App	833rd App	834th App	835th App	836th App	837th App	838th App	839th App	840th App	841st App	842nd App	843rd App	844th App	845th App	846th App	847th App	848th App	849th App	850th App	851st App	852nd App	853rd App	854th App	855th App	856th App	857th App	858th App	859th App	860th App	861st App	862nd App	863rd App	864th App	865th App	866th App	867th App	868th App	869th App	870th App	871st App	872nd App	873rd App	874th App	875th App	876th App	877th App	878th App	879th App	880th App	881st App	882nd App	883rd App	884th App	885th App	886th App	887th App	888th App	889th App	890th App	891st App	892nd App	893rd App	894th App	895th App	896th App	897th App	898th App	899th App	900th App	901st App	902nd App	903rd App	904th App	905th App	906th App	907th App	908th App	909th App	910th App	911st App	912nd App	913rd App	914th App	915th App	916th App	917th App	918th App	919th App	920th App	921st App	922nd App	923rd App	924th App	925th App	926th App	927th App	928th App	929th App	930th App	931st App	932nd App	933rd App	934th App	935th App	936th App	937th App	938th App	939th App	940th App	941st App	942nd App	943rd App	944th App	945th App	946th App	947th App	948th App	949th App	950th App	951st App	952nd App	953rd App	954th App	955th App	956th App	957th App	958th App	959th App	960th App	961st App	962nd App	963rd App	964th App	965th App	966th App	967th App	968th App	969th App	970th App	971st App	972nd App	973rd App	974th App	975th App	976th App	977th App	978th App	979th App	980th App	981st App	982nd App	983rd App	984th App	985th App	986th App	987th App	988th App	989th App	990th App	991st App	992nd App	993rd App	994th App	995th App	996th App	997th App	998th App	999th App	1000th App
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This table lists chemical and non-chemical control methods for the major pests on aspen in California. Explanations of the columns is given in the following table. Data is from the 1988 Pest Management Survey Database, which was developed jointly by DPR and the UC statewide IPM Project. Department of Pesticide Regulation - April 15, 1988

Pest	Pest type	AI or Control Method	Region	Rating	Explanation for rating of 3	Limitations	1st 2nd No	3rd 4th 5th 6th 7th 8th 9th 10th 11th 12th 13th 14th 15th 16th 17th 18th 19th 20th 21st 22nd 23rd 24th 25th 26th 27th 28th 29th 30th 31st 32nd 33rd 34th 35th 36th 37th 38th 39th 40th 41st 42nd 43rd 44th 45th 46th 47th 48th 49th 50th 51st 52nd 53rd 54th 55th 56th 57th 58th 59th 60th 61st 62nd 63rd 64th 65th 66th 67th 68th 69th 70th 71st 72nd 73rd 74th 75th 76th 77th 78th 79th 80th 81st 82nd 83rd 84th 85th 86th 87th 88th 89th 90th 91st 92nd 93rd 94th 95th 96th 97th 98th 99th 100th 101st 102nd 103rd 104th 105th 106th 107th 108th 109th 110th 111th 112th 113th 114th 115th 116th 117th 118th 119th 120th 121st 122nd 123rd 124th 125th 126th 127th 128th 129th 130th 131st 132nd 133rd 134th 135th 136th 137th 138th 139th 140th 141st 142nd 143rd 144th 145th 146th 147th 148th 149th 150th 151st 152nd 153rd 154th 155th 156th 157th 158th 159th 160th 161st 162nd 163rd 164th 165th 166th 167th 168th 169th 170th 171st 172nd 173rd 174th 175th 176th 177th 178th 179th 180th 181st 182nd 183rd 184th 185th 186th 187th 188th 189th 190th 191st 192nd 193rd 194th 195th 196th 197th 198th 199th 200th 201st 202nd 203rd 204th 205th 206th 207th 208th 209th 210th 211st 212nd 213th 214th 215th 216th 217th 218th 219th 220th 221st 222nd 223rd 224th 225th 226th 227th 228th 229th 230th 231st 232nd 233rd 234th 235th 236th 237th 238th 239th 240th 241st 242nd 243rd 244th 245th 246th 247th 248th 249th 250th 251st 252nd 253rd 254th 255th 256th 257th 258th 259th 260th 261st 262nd 263rd 264th 265th 266th 267th 268th 269th 270th 271st 272nd 273rd 274th 275th 276th 277th 278th 279th 280th 281st 282nd 283rd 284th 285th 286th 287th 288th 289th 290th 291st 292nd 293rd 294th 295th 296th 297th 298th 299th 300th 301st 302nd 303rd 304th 305th 306th 307th 308th 309th 310th 311st 312nd 313th 314th 315th 316th 317th 318th 319th 320th 321st 322nd 323rd 324th 325th 326th 327th 328th 329th 330th 331st 332nd 333rd 334th 335th 336th 337th 338th 339th 340th 341st 342nd 343rd 344th 345th 346th 347th 348th 349th 350th 351st 352nd 353rd 354th 355th 356th 357th 358th 359th 360th 361st 362nd 363rd 364th 365th 366th 367th 368th 369th 370th 371st 372nd 373rd 374th 375th 376th 377th 378th 379th 380th 381st 382nd 383rd 384th 385th 386th 387th 388th 389th 390th 391st 392nd 393rd 394th 395th 396th 397th 398th 399th 400th 401st 402nd 403rd 404th 405th 406th 407th 408th 409th 410th 411st 412nd 413th 414th 415th 416th 417th 418th 419th 420th 421st 422nd 423rd 424th 425th 426th 427th 428th 429th 430th 431st 432nd 433rd 434th 435th 436th 437th 438th 439th 440th 441st 442nd 443rd 444th 445th 446th 447th 448th 449th 450th 451st 452nd 453rd 454th 455th 456th 457th 458th 459th 460th 461st 462nd 463rd 464th 465th 466th 467th 468th 469th 470th 471st 472nd 473rd 474th 475th 476th 477th 478th 479th 480th 481st 482nd 483rd 484th 485th 486th 487th 488th 489th 490th 491st 492nd 493rd 494th 495th 496th 497th 498th 499th 500th 501st 502nd 503rd 504th 505th 506th 507th 508th 509th 510th 511st 512nd 513th 514th 515th 516th 517th 518th 519th 520th 521st 522nd 523rd 524th 525th 526th 527th 528th 529th 530th 531st 532nd 533rd 534th 535th 536th 537th 538th 539th 540th 541st 542nd 543rd 544th 545th 546th 547th 548th 549th 550th 551st 552nd 553rd 554th 555th 556th 557th 558th 559th 560th 561st 562nd 563rd 564th 565th 566th 567th 568th 569th 570th 571st 572nd 573rd 574th 575th 576th 577th 578th 579th 580th 581st 582nd 583rd 584th 585th 586th 587th 588th 589th 590th 591st 592nd 593rd 594th 595th 596th 597th 598th 599th 600th 601st 602nd 603rd 604th 605th 606th 607th 608th 609th 610th 611st 612nd 613th 614th 615th 616th 617th 618th 619th 620th 621st 622nd 623rd 624th 625th 626th 627th 628th 629th 630th 631st 632nd 633rd 634th 635th 636th 637th 638th 639th 640th 641st 642nd 643rd 644th 645th 646th 647th 648th 649th 650th 651st 652nd 653rd 654th 655th 656th 657th 658th 659th 660th 661st 662nd 663rd 664th 665th 666th 667th 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APPENDIX 3



UC Pest Management Guidelines

STRAWBERRY

ANGULAR LEAF SPOT

Pathogen: *Xanthomonas fragariae*
(Reviewed: 08/95, updated: 05/91)

IN THIS GUIDELINE:

SYMPTOMS

COMMENTS ON THE DISEASE

COMMENTS ON CONTROL

CULTURAL CONTROL

ORGANICALLY ACCEPTABLE METHODS

WHEN TO TREAT

TREATMENT

PUBLICATION

GLOSSARY



SYMPTOMS:

Infection first appears as minute, water-soaked spots [92K] on the lower surface of leaves. The lesions enlarge to form translucent, angular spots that are delineated by small veins and often exude a viscous ooze, which appears as a whitish and scaly film after drying. As the disease progresses, lesions [95K] coalesce and reddish brown spots, which later become necrotic, appear on the upper surface of the leaves. A chlorotic halo usually surrounds the infected area.

COMMENTS ON THE DISEASE:

This bacterium is not free living in soil. It can, however, overwinter in soil on previously infected plant material. Transmission is by splashing water. It is host specific and highly resistant to degradation - it can persist in the soil for long periods of time. It is killed by methyl bromide/chloropicrin mixture used as a preplant fumigant, so it is very likely that most initial infections in fields that have been fumigated originate from contaminated plants. Lesions on the leaf surface serve as a source for secondary inoculum and cells are dispersed by splashing rain or overhead irrigation. The disease is favored by cool, moist days with cold nights near freezing.

Although uncommon in California, *Xanthomonas fragariae* can cause vascular collapse. This symptom initially appears as a water-soaked area at the base of newly emerged leaves. Shortly after, the whole plant suddenly dies, much like plants infected with crown rot.

COMMENTS ON CONTROL:

Chemical controls are typically ineffective against this pathogen. Copper containing compounds are registered but have caused phytotoxicity with repeated applications. Preplant fumigate with methyl bromide/chloropicrin mixture.

CULTURAL CONTROL:

Use clean planting stock and avoid overhead irrigation when possible.

ORGANICALLY ACCEPTABLE METHODS:

Cultural controls.

WHEN TO TREAT:

Chemical controls are generally not cost effective.

TREATMENT:

Pesticide (commercial name)	Amount/Acre**	P.H.I.+ (days)	Comments
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A. FIXED COPPERS# Label rates

Repeat applications may be
phytotoxic to plants.

** Apply all materials in 200 gal water/acre to ensure adequate coverage.

* Permit required from county agricultural commissioner for purchase or use.

+ Preharvest interval. Do not apply within this many days of harvest.

PRECAUTIONS**PUBLICATION:**

UC IPM Pest Management Guidelines: Strawberry

D. Gubler

UC DANR Publication 3339

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NEW PEST

NEW CROP

UC IPM HOME

HELP DESK



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UC Pest Management Guidelines

STRAWBERRY ANTHRACNOSE

Pathogen: *Colletotrichum acutatum*
(Reviewed: 08/95, updated: 08/95)

IN THIS GUIDELINE:

SYMPTOMS

COMMENTS ON THE DISEASE

COMMENTS ON CONTROL

CULTURAL CONTROL

ORGANICALLY ACCEPTABLE CONTROLS

WHEN TO TREAT

TREATMENT

PUBLICATION

GLOSSARY



SYMPTOMS:

Dark elongated fusiform lesions [63K] appear on petioles and runners, and often girdle the stem. On fruit, light tan to light brown water-soaked lesions [80K] develop and turn into sunken black lesions. Both ripe and unripe fruit can be affected. Wilting or dying plants [72K] infected with Anthracnose crown rot tend to have a red to brown streaking [74K] in the interior of the crown.

COMMENTS ON THE DISEASE:

Warm or cool, wet conditions favor the development of fruit and stem rot. Fungus overwinters in plant debris or alternate weed hosts.

COMMENTS ON CONTROL:

Use protective fungicides such as benomyl or captan. Disease is most common on varieties that fruit in the nursery. Contamination may occur in fruit production fields as a result of nursery infections or contamination of planting material.

CULTURAL CONTROL:

Use drip or furrow irrigation and clean planting stock.

ORGANICALLY ACCEPTABLE CONTROLS:

Cultural controls.

WHEN TO TREAT:

Treat in nurseries when day neutral varieties begin to fruit. Treat in fields before an expected rain.

TREATMENT:

Pesticide (commercial name)	Amount/Acre**	P.H.I.+ (days)	Comments
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A. BENOMYL (Benlate)	1 lb		
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...PLUS...

CAPTAN 50WP 4 lb

COMMENTS: Do not apply in combination with, immediately before, or closely following oil sprays.

- ** Apply all materials in 200 gal water/acre to ensure adequate coverage.
- + Preharvest interval. Do not apply within this many days of harvest.

PRECAUTIONS

PUBLICATION:

UC IPM Pest Management Guidelines: Strawberry

D. Gubler

UC DANR Publication 3339

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